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REPORT ON THE FOUNDATION ROLLING BRANDYWINE ARTERIAL EXTENSION (ROUTE 7) CITY OF BINGHAMTON, NEW YORK

STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
BUREAU OF SOIL MECHANICS

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FOUNDATION ROLLING
BRANDYWINE ARTERIAL EXTENSION (ROUTE 7)
CITY OF BINGHAMTON, NEW YORK

ALBANY, NEW YORK DECEMBER 1949

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INTRODUCTION

This report presents the information obtained from a field investigation of the effectiveness of a heavy pneumatic tired roller in compacting a loose refuse fill by surface rolling.

This investigation was conducted at the site of the proposed Brandywine Arterial Extension (Route 7) in the City of Binghamton, New York. The present foundation between Stations 51+00 and 96+00 of this project consists of a city dump fill, varying in age from approximately 1 to 15 years, and extending to a depth variable from 5 to 25 feet.

The tests were undertaken to verify the belief that the upper layer of such a heterogeneous, loose fill could be compacted sufficiently by heavy surface rolling to eliminate local weak spots, and to give a uniform bearing value capable of supporting the intended fill embankments without distortion. The data obtained were necessary to determine the feasibility of this procedure of field construction, to prepare estimates of quantities, and to formulate specifications covering the work.

DESCRIPTION OF SITE

The dump fill site within the limits of the Brandywine Arterial Extension extends approximately from Station 51+00 to Station 96+00. The fill is made up of the usual material found in such dump areas; including food refuse, paper and wood, glass, metals - such as tin cans and bed springs, ashes, and other miscellaneous matter, such as rubber tires and rags. The various percentages of these materials vary widely with depth and in horizontal directions, depending upon the season of the year and the rate of dumping. Following the usual practices of land fill construction, a light cover of earth blankets the entire fill, which was placed with no specific effort to obtain compaction. The area consequently is a random, irregular fill, with wide variations in density and load carrying capacities. No record is available of the ages of the sections of this fill.

Prior to the construction of the dump fill this area was the location of a meandering creek in low flat lands, and consequently, the material underlying the fill consists of unconsolidated muck, silt, and clay. In some locations scattered pockets of mixtures of fine sand, gravel, and silt, are found at varying depths below the original ground surface. Figures A-11 and A-12 of Appendix A show the depth of the dump fill and the underlying soil profile within this area.

A review of the existing literature on the characteristics of land dump fills indicates that the settlement expected in such fills is due to two separate factors. The first of these is the settlement due to physical factors and mechanical adjustments and accounts for the major portion of the settlement.

This physical settlement can be subdivided into two components. The first component is the settlement due to the weight of the fill itself. This value has been measured to be approximately 30 percent of the height of fill, with 20 percent taking place during the first 6 months, and the remaining 10 percent during the following 18 months. The fill generally reaches stability under its own weight in approximately 2 years. The second component of the physical settlement is that which takes place due to a superimposed load on the fill, such as a highway fill or a structure. This settlement will continue for a period following construction, with the actual amount and rate being a function of the nature of the local fill material and the superimposed load.

The second factor contributing to settlement is that due to the decomposition of the refuse material in the fill. The amount of this settlement is relatively small, compared to the physical settlement, but it continues to take place for 30 or more years. However, experience has shown that, because of the minor value of this settlement, it is not necessary to wait until

ultimate stability is reached before proceeding with the use of the filled area.

CONSTRUCTION METHODS CONSIDERED

At a meeting held on February 15, 1949, at the Department of Public Works District Office in Binghamton, New York, which was attended by Messrs. F.W. Donovan, H.W. Morss, L.W. Swank, and M.N. Sinacori, the various possible methods of construction were discussed. Among these were the following:

1. Removal of the unsuitable material by excavation and backfilling with acceptable borrow. This method was considered very expensive and impractical due to: (a) the large quantities involved; (b) the problem of finding a suitable waste area well beyond the city limits, and its consequent long haul; and, (c) the sanitary precautions necessary for handling the material at the site and through the city streets.

2. Building the fill on the foundation in its present state, without any excavation, and untreated in any manner. It was felt that this procedure would result in a pavement reflecting considerable unevenness and local differential settlement, and which would require large expenditures for maintenance after construction. In addition, the pavement would generally be rough riding and dangerous.

3. Stabilizing the foundation by the injection of chemicals or grouting materials. This method was

considered to be uncertain and expensive due to the large number of close-spaced holes required for adequate coverage.

4. Compacting the foundation in place to a greater density and a higher bearing value to the maximum obtainable depth, by a heavy impact or rolling load. Of these it was felt that a heavy rolling load would be the more practical and economical, and was the method developed and covered in this investigation.

SCOPE OF INVESTIGATION

Preparations for the investigation were predicated on the belief that a heavy pneumatic tired roller rolled over the area a sufficient number of times would compact the upper portion of the dump fill to furnish a satisfactory bearing value, and designate the local weak spots, which might be treated separately. It was felt that this method would develop a compacted crust several feet in thickness as the upper layer of the foundation dump fill, pre-consolidated by the rolling to reduce the settlement expected due to the superimposed fill load. On this would be added several additional feet of well compacted fill. The combination of these would support a flexible pavement sufficiently to eliminate abrupt differential settlements, and minimize the gradual settlement covering long stretches.

To determine the feasibility of such a method, and to obtain specific information with which to prepare the necessary plans and specifications, field data was required to cover the following points:

1. The effective weight or weights of roller needed to compact the foundation to a satisfactory density.

2. The order of increasing the roller weight to obtain satisfactory rolling without causing too much lateral displacement, or deep ruts that would interfere with

the rolling operations.

3. The number of roller passes required.

4. The effect of these operations on the dump fill areas of different ages.

5. The depths to which the rolling was effective in contributing to a compacted crust.

EQUIPMENT USED

Before the investigation was started, some thought was given to the possible type and weight of equipment which could be used to meet the developed requirements. At this time, the William Bros Boiler and Manufacturing Company of Minneapolis, Minnesota, offered the use of their new 50-Ton Compactor, recently put on the market by them. It was therefore decided to use this Bros roller for the investigation, as it was felt that it met the requirements.

The roller consists of a large metal box approximately 17 feet long by 8 feet wide, under which are centered two axles in line, each with two rubber tires of size 18:00 x 24-24 ply. A tongue neck extends from the box to two front dolly wheels, and a tie-bar connects the dolly wheels to the tractor. The empty weight of the roller is 12 tons, and the box is of such capacity that it can be loaded with saturated sand to a total weight of 50 tons. For this experiment, the roller was used at three different weights: empty weighing 12 tons, loaded to half load at 31 tons, and finally loaded to full capacity at a total weight of 50 tons.

During the tests, the roller was pulled first by a D-7 Caterpillar Tractor furnished by the Bero Engineering and Construction Company, and later by an HD-19 Allis-Chalmers Tractor furnished by the McDougall

Equipment Company of Binghamton, New York. The equipment used was furnished by these organizations at no cost to the State, but as a contribution to the development of the experiment.

TEST PROCEDURES

For the investigation, seven test strips were laid in various locations on the dump fill in such a manner that fills of different ages and composition would be included. Each test strip was 200 feet long and 20 feet wide. The locations of these test strips are shown in Figure A-11. After they were laid out, these test strips were cross-sectioned and referenced to established bench marks. During the rolling, additional cross-sections and profiles were taken periodically in every test strip to measure the amount of settlement or displacement taking place as a function of the number of roller passes and the weight of roller used.

In the first five test strips, the compaction tests were made in three separate stages. The first stage consisted of rolling the area with 12 full passes of the empty roller, which weighed 12 tons. In the second stage, the roller was loaded to a total weight of 31 tons, and the areas were rolled 12 additional times. Finally with the roller loaded to its capacity of 50 tons, the rolling was continued until no measurable settlement was noticed in these test strips. During these operations, local weak spots developed, into which the roller sank as much as 4 feet. These areas were backfilled and leveled off with a thin layer of sand and gravel before the rolling was continued.

The last two test strips were compacted only with the roller loaded to a total weight of 50 tons. It was thought advisable to compare the behavior of the roller fully loaded on material not previously compacted, to that on material previously compacted by light rolling, and to notice the number and depths of local depressions by a comparison of the two methods.

Attempts were made to measure the effects of rolling on the density of the dump fill material in place and on the depth to which the rolling was effective. The taking of samples to measure natural densities in place was not practicable because of the nature of the material. Two other methods, however, were used to obtain a measure of the relative change in density with depth. The first of these was the use of the electrical resistivity apparatus. The second method was the use of probing rods driven into the ground under standard conditions, and recording the number of blows for each foot of penetration.

Electrical Resistivity:-The use of the electrical resistivity apparatus in itself was an experiment, insofar as this method had not been used before for such work. The apparatus measures the resistance of an electrical current flowing through the soil material. It is known that the resistance of a material is lessened with an increase in the density of that material. The depth at which the resistance is being measured is

dependent chiefly on the spacing of the electrodes on the ground. Two types of tests were used: The first is known as the point test, in which the electrode spacing, which controls the depth to which measurable effects are produced, was changed progressively from 1 to 20 feet. The second type of resistivity test made was the traverse test, in which the electrode interval is maintained constant and is progressed from one end of the line to the other. The point test gives a picture of changing resistance with depth, while the traverse test indicates the horizontal changes at a uniform depth. The results of these tests have been computed and plotted, and are included in Appendix C.

Probing Rods:-The relative increase in density due to rolling, measured by the use of probing rods, was done by driving into the ground 1-5/8 inch diameter rods with a 250 lb. hammer, dropped through a height of 6 inches. The number of blows required to drive the rods for each foot of depth was recorded. The variation in the number of blows was considered a relative measure of the change in density of the material. The probing rods were driven at various locations to include the portions of the fill which had not been rolled, and also others which had been given complete rolling coverage. By comparing the results of these two areas, the increase in resistance to penetration was attributed to an increase in density due to the surface rolling operations. The results of these tests are given in Appendix D.

TEST RESULTS

The test results obtained during the investigation were computed, analyzed, and plotted in several ways to show the required relationships. Each test strip included 6 control sections across which profiles were taken at 2-foot intervals within the compacted width of 20 feet. The 6 control sections were laid out for each test strip as shown in Figure B-1 for Test Strip No. 3.

Profiles across these control sections were taken periodically during the rolling operations and were correlated with the number of passes and the various weights of roller used. Centerline profiles and additional sections at some of the weakest locations between these standard sections were taken as the investigation developed. To maintain control during the rolling operations, the average settlement across each of the 6 control sections for each test strip was plotted directly in the field against the number of passes given.

In the rolling operations, one pass was taken to represent two trips of the roller, each trip offset from the other the width of the one tire to obtain complete area coverage.

Figures B-2 to B-6 show the resulting average settlement obtained across each control section, plotted versus the number of roller passes given for the corresponding weights of roller. These plots show that the

12-ton roller gave an average settlement of 0.3 feet after 12 passes. The major portion of this settlement developed during the first 4 to 6 passes. The 12 additional passes of the 31-ton roller gave from 0.6 to 0.7 feet of additional settlement, for an average total of approximately 1 foot. The major portion of the settlement developed with the 31-ton roller was obtained during the first 8 passes. The 50-ton roller further increased the settlement to an average of 2 feet. The major portion of this settlement was realized during the first 20 to 25 passes of the roller. Further rolling with the 50-ton roller resulted in additional settlement, but the actual amount was relatively small.

Figures B-7 and B-8 show the settlement data plotted for Test Strip Nos. 6 and 7. In these two strips only the 50-ton roller was used, without prior rolling with a lighter weight roller. In Test Strip No. 6 a maximum of 2 feet of settlement was obtained in approximately 25 to 30 passes, at which time relative stability was obtained. Test Strip No. 7 showed approximately 1.7 feet of settlement during the first 5 passes of the 50-ton roller. The test on this strip was discontinued due to the very bad rutting that developed in some locations. This appeared to be one of the weaker strips tested, and would have given considerably more settlement if the test had been continued until stability was obtained.

The relationship between the average and maximum settlements is shown plotted in Figures B-9 and B-11 for several of the test sections recorded. On the average, the maximum local settlement within each test section was approximately 50 percent greater than the average settlement, with some sections showing as much as 100 percent variation.

The data was also plotted to show the cross sectional profile of the surface at each control section. These profiles are shown plotted in Figures B-12 to B-47, and are referenced with the number of passes required to give the developed profiles. On the average, the greatest settlement shown plotted on these sections was approximately 3-1/2 feet. In some of the locations between these control sections, settlement up to 4 feet was recorded.

It should be pointed out that there is considerable variation in the amount of settlement obtained, even across the narrow 20-foot width of the sections measured. In general, all of these sections show a greater settlement along the center of the test strip than toward the outside edges. This variation may have been due to the overlapping effects of the rolling, since one coverage over the full width of the test strip was composed of two passes, one pass covering each side of the centerline. The recorded differential settlement in some sections was as much as 3 feet.

Several of the centerline profiles developed during the investigation are shown plotted in Figure B-48. These accentuate the variability of the material within each test strip.

Electrical Resistivity:-The results of the electrical resistivity tests are shown plotted in Appendix C in two groups of curves. The first group, plotted in Figures C-1 to C-11, give the results of the point tests, which show the change of resistance with depth at one location. The second group, plotted in Figures C-12 to C-18, give the results of the traverse tests, which indicate the horizontal changes in resistance at a uniform depth. It should be pointed out that the results of this portion of the investigation are only qualitative, insofar as the relationship between the values of the resistance of the material to the passage of an electrical current and the corresponding density is unknown at this time. In general, the resistivity work was performed at the same locations within the test strips before and following each rolling operation. However, due to the lapse of time between these groups of tests, other variables may have come into being, such as rainfall which occurred during that period and which affected the resistance of the material.

Because of the local conditions, the effects of the decreased resistance were felt within the areas at varying depths up to 14 to 18 feet. However, analyzing

the data with allowances for these local variations, the point tests (Figures C-1 to C-11) show that rolling with the 12-ton roller was effective to an average depth of approximately 4 feet. Rolling with the 31-ton roller was effective to an average depth of approximately 6 feet, and rolling with a 50-ton roller was effective to an average depth of approximately 8 to 9 feet.

Except for local variations, the traverse test results (Figures C-12 to C-18) show that the measured resistance of the fill material showed a decrease in value to a depth of 10 feet, as the result of rolling. Where a traverse was made following rolling with the 12 and 31-ton roller and again following rolling with the 50-ton roller, the rolling with the 50-ton roller resulted in a further decrease in the resistance when compared to the values following the rolling with the 31-ton roller. The resistance obtained has been assumed as representing inversely a measure of the density of the material.

Probing Rods:-The results obtained from the use of probing rods to measure the relative increase in density due to rolling are given in Appendix D. The values of resistance to penetration as a function of the depth below the surface were averaged for the points within each test strip, to obtain a more representative relationship. These average values are shown plotted

in Figures D-1 to D-5. The individual results are included in table form in Figures D-6 to D-10.

All the work done with probing rods was undertaken after the rolling operations were completed. Consequently, in order to correlate the effects of rolling on the density as measured by the increased resistance to penetration of the rods, two groups of holes were driven in the area tested. The first group of holes was located adjacent to the test strips on material that had not been rolled, and represents the area before rolling. The second group was located along the same stations, but within the rolled test strips, and represents the area after it was rolled. This difference in locations introduced additional variables due to the heterogeneous nature of the material, which were evident in the test results. However, an analysis of the test data showed that the number of blows required to drive the probing rods into the ground in the rolled test strips was generally greater than those driven outside of the rolled test strips. The variation in the number of blows required to drive the probing rods for the first 10 feet has been averaged and is shown in the following summary.

	In areas not rolled	In areas completely rolled
Cumulated number of blows to drive probing rods from 0 to 5 feet.	65	130
Average number of blows per foot to drive rods from 0 to 5 feet.	13	26
Cumulated number of blows to drive probing rods from 5 to 10 feet.	45	73
Average number of blows per foot to drive rods from 5 to 10 feet.	9	15

The curves generally show that an increase in resistance to penetration has been realized to a depth of approximately 8 feet. The number of blows required to drive the rods through the top 5 feet in the areas completely rolled was approximately double the corresponding number of blows in the areas not rolled. Beyond a depth of 10 feet, the variations obtained are only within the limits of error assumed.

SUMMARY

The following summary has been obtained from the details of the investigation:

1. The dump fill within the limits of the Brandywine Arterial Extension can be pre-consolidated by rolling with a heavy pneumatic tired roller. This rolling should develop a compacted crust sufficiently thick to offer relatively uniform support to a light fill and permit the construction of a serviceable flexible pavement.

2. The settlement obtained in the foundation due to rolling with the empty roller weighing 12 tons was relatively small. This value averaged approximately 0.3 feet over the entire area. It is felt that the 12-ton roller is too light for effective rolling, and should not be used during construction.

3. Rolling the foundation directly with the roller fully loaded to 50 tons without prior rolling with a lighter roller developed many deep ruts and holes with the first few roller passes. In addition to tearing and loosening the material, this method slowed down operations considerably, insofar as too much time was spent in pulling the roller out of these depressions. The 30-ton roller, however, did not cause too much difficulty in this respect.

4. The data shows that the bulk of the settlement due to the 30-ton roller was realized within the first 6 to 8 passes. The few additional passes increased the amount of settlement very little.

5. Using the 50-ton roller, the major portion of the settlement was obtained in approximately 20 to 25 passes. Additional minor settlement was obtained with further rolling.

6. Observations made during the testing program indicated that there is no practical means of setting up standards or procedures in the field to measure the settlement or required stability, without interfering with the construction schedule.

7. The rolling operations proceeded most smoothly when all ruts and local depressions which developed during rolling were backfilled with granular material. It was observed during the investigation, however, that if too thick a layer of sand and gravel were spread, it reduced the effectiveness of rolling and prevented additional settlement.

8. During the investigation, there were no local weak spots encountered which could not be strengthened by backfilling and re-rolling as described in the

report. Although there may be such locations in the area, no special provisions need be made for the removal of any material by excavation.

9. The electrical resistivity apparatus showed that rolling with the 30-ton roller was felt to a depth of approximately 6 feet, and that rolling with the 50-ton roller was felt to a depth of 8 to 9 feet. The results of the rod probings showed an increase in resistance to driving to an average depth of 8 feet. There were some areas which showed no change in resistance, while others showed change to a greater depth. Although it is not known what the direct relationship is between the change in resistance to the flow of an electric current and the change in density, nor the relationship between the number of blows on the rods and the density, it has been concluded that a crust has been formed on the surface of the dump fill which has a greater density and bearing value than before rolling, and which is affected to a depth of at least 5 feet.

10. The results of the investigation show that an average area settlement of 2 to 2-1/2 feet may be expected due to the foundation rolling.

RECOMMENDATIONS

From the results of the investigation, the following recommendations are made to aid in the detailed design and the preparation of specifications for the portion of the Brandywine Arterial Extension between Stations 51 and 96.

1. The rolling operations throughout the area be carried on in two stages. The first stage should include complete coverage with the roller weighing from 25 to 30 tons. The second stage rolling should then follow using the roller weighing a total of 50 tons. The rolling should cover the area from toe to toe of slope.

2. The preliminary or first stage rolling be set up to include 8 passes of the 30-ton roller throughout the area. The second stage rolling should be estimated on the basis of 30 additional passes of the 50-ton roller. On the basis of these 38 passes of the roller at an average speed of 2 miles per hour, there will be required approximately 400 rolling hours for the foundation rolling operations. It is recommended that this value be rounded to 500 rolling hours for estimating purposes.

3. The tentative unit price of the rolling operation, exclusive of the cost of the roller, has been

estimated approximately at \$25.00 per hour, as follows:

D-8 Tractor and Operator	\$7.00 per hr.
D-8 Bulldozer and Operator	8.00 per hr.
Fuel, maintenance, insurance, profits, etc.	10.00 per hr.
	\$25.00 per hr.

The unit price of the roller, based on a prorated rental rate of \$1000.00 per month, would be approximately \$5.00 per hour. However, if the cost of the roller were charged off to this project, its unit price would be \$25.00 per hour, based on a cost of \$12,500.00, and 500 rolling hours. The total unit price for the complete operation would then be either (a) \$30.00 per hour, or (b) \$50.00 per hour. The corresponding total estimated price for the foundation rolling would be either (a) \$15,000.00, or (b) \$25,000.00, exclusive of the price of Item 2EC. The actual unit price bid probably will be dependent on the availability of the roller, and on its anticipated future use. Additional information is required to arrive at a more reasonable estimate.

4. The depressions developed in the foundation during rolling operations should be backfilled with selected borrow, Item 2EC. The quantity should be the minimum required to level off the area and permit continued easy rolling. It is estimated

that there may be needed approximately 12 inches of selected borrow over the entire area, with the actual quantity at any location varying with local conditions. On this basis, there will be needed approximately 20,000 cubic yards for the area between Stations 51 and 96. It is recommended that 20,000 cubic yards of Item 2EC be provided for this portion of the project. A note should be added to the plans explaining that the minimum amount of Item 2EC required for ease of rolling will be used, and that, depending upon local conditions during construction, only a portion of it may actually be used.

5. Since it is not practical to set up a field procedure to measure the settlement during rolling, it it recommended that the Engineer on the project decide by visual and measured observations when sufficient rolling has been obtained.

6. The rolling operations will be more efficient and economical if the individual areas for rolling are planned of sufficient length to reduce to a minimum the relative time required for turning. The Engineer on the job should be permitted to approve the stretches laid out for rolling to obtain as long a section as field conditions permit. Turn-around areas at the ends of the rolling section should be wide and satisfactorily prepared to

reduce the time for turning around.

7. The approach fill at the intersection of Bevier Street, in the vicinity of Station 96, will be approximately 18 feet high. The weight of this fill on the foundation may be considerably greater than any pre-consolidation effect we might realize from the rolling operations, and it is expected that further settlement will be obtained in the foundation during and after construction. The amount of this settlement cannot be estimated, but will be a function of the age and type of material found in that foundation. It is recommended that this fill be built first to permit sufficient time for natural settlement and adjustment of the foundation under the superimposed load. The foundation should be first rolled in the same manner as the rest of it, planning to increase the amount of rolling with the 50-ton roller to 40 or more passes.

8. Our attention has been called to the existence of a storm water sewer line along the left side of the arterial route section. If this storm sewer line is within 8 feet of the surface, and within the section to be rolled in any area, precaution should be taken so that the heavy rolling will not damage the line.

9. Wherever local conditions permit, it is recommended that grade elevation be established a minimum of four feet above present ground line.

10. In cut sections, it is recommended that the area be excavated to one foot below subgrade level before the foundation rolling is started.

11. Based on an anticipated average area settlement of 2 feet due to the foundation rolling, approximately 40,000 cubic yards of common borrow should be added to the quantities, to compensate for the settlement and the fill to be added below present ground level between Stations 51± and 96±.

12. Because of the possible future settlement that may develop, it is recommended that the pavement through this portion of the project be designed as a flexible pavement.

13. The quantities and costs covered in this report are for estimating purposes for the section of the project between Stations 51± and 96±. These should be reviewed by the District when incorporated in the total job quantities.

RECOMMENDED TENTATIVE SPECIFICATIONS

ITEM SPECIAL EMBANKMENT FOUNDATION ROLLING

(a) Work:-Under this Item the Contractor shall roll the embankment foundation with an approved pneumatic tired roller as directed by the Engineer.

Approved pneumatic tired equipment for rolling shall be of such capacity that the load may be varied from 30 to 50 tons. This load must be transmitted through two axles acting in a line perpendicular to the centerline of the roller to permit oscillating action. The total axle load shall be transmitted to the ground on four pneumatic tires. The pneumatic tires shall be evenly spaced across the entire width of the roller, and shall be attached two to each axle. The axles shall be so attached to the body of the roller that oscillation will be obtained in each set of two tires.

The rolling shall cover the entire foundation area between the toes of slope, from Station 51± to Station 96±. These stations are approximate and may be varied in the field depending on local conditions. Preliminary rolling shall be done with a 30-ton axle load. It is expected that the amount of preliminary rolling required will be approximately 8 passes over the entire area.

The axle load shall then be increased to a total load of 50 tons. Final rolling shall be done with the 50-ton axle load. This rolling shall be continued until the degree of stability of the foundation as required by the Engineer has been obtained. It is expected that the amount of rolling required with the roller loaded to a total weight of 50 tons will be approximately 25 to 30 passes over the entire area to be covered.

In rolling, one pass shall be taken to represent two trips of the roller, each trip offset from the other the width of one tire to obtain complete area coverage.

As the rolling progresses, the irregularities between tire marks shall be leveled off to facilitate compaction and to permit complete area coverage by the tires. All local depressions which interfere with the rolling operations shall be backfilled with Selected Borrow - Item 2EC.

The amount of backfill to be used for these operations shall be kept to the minimum required to permit easier rolling operations. When the condition of the foundation is satisfactory for normal rolling, the speed of the roller shall be not less than 2-1/2 miles per hour.

(b) Payment:-The quantity to be paid for under this Item shall be the number of hours of rolling performed by the special rolling equipment. No payment will be made for idle equipment due to repairs, bad weather, wet subgrade, or for any other reason.

The time of rolling shall be recorded to the nearest minute by the Contractor. This time shall be checked daily by the Engineer.

The unit price bid for this Item shall include the cost of furnishing all labor, materials, fuel, equipment, and repairs necessary to complete the work, except the Selected Borrow used during these rolling operations will be paid for under its respective Item.

ACKNOWLEDGMENTS

This investigation was carried on under the general supervision of Mr. F.W. Donovan, District Engineer of District No. 9, Binghamton, New York. The field work was conducted under the direct supervision of Mr. L.W. Swank, formerly Assistant Soils Engineer and now Senior Civil Engineer of District No. 9, Binghamton, New York. Mr. P.H. Bird, Senior Engineering Geologist of the Bureau of Soil Mechanics, Albany, New York, was responsible for the Electrical Resistivity work made during this investigation. Mr. M.N. Sinacori, Associated Soils Engineer, Bureau of Soil Mechanics, Albany, New York, was in charge of the planning and coordination of the work, analyzed the data, and prepared this report.

The Department wishes to express sincere appreciation to the William Bros Boiler and Manufacturing Company who offered the use of their 50-ton roller, to the Bero Engineering and Construction Company of Buffalo, New York, for the use of one of their D-7 Caterpillar Tractors, and to the McDougall Equipment Company of Binghamton, New York, for the use of their HD-19 Allis-Chalmers Tractor. This investigation was made possible by the cooperation of these organizations.

APPENDIX A

Fig. A-1 Rear View of roller showing tire spacing.

Fig. A-2 Roller loaded to 31 tons being pulled out of soft spot in turn-around area at end of Test Strip No. 2.

Fig. A-3 Test Strip No. 1 during rolling with 31-ton roller, showing irregularity of foundation under loose conditions. Surface material wet after rain.

Fig. A-4 Test Strip No. 2 following rolling with 50-ton roller, showing several weak spots.

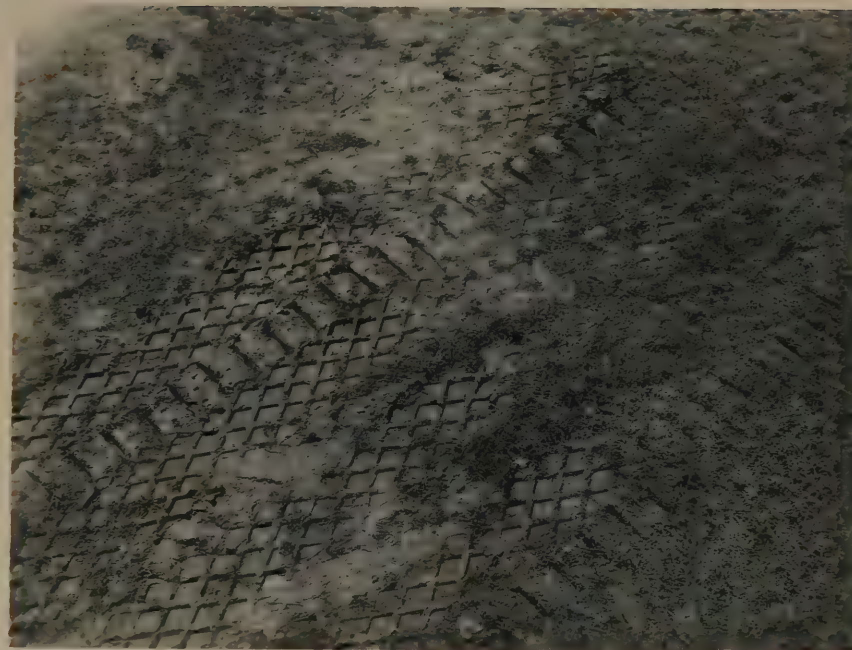


Fig. A-5 Close-up of well-compacted stable surface during rolling with 50-ton roller. Test Strip No. 5.

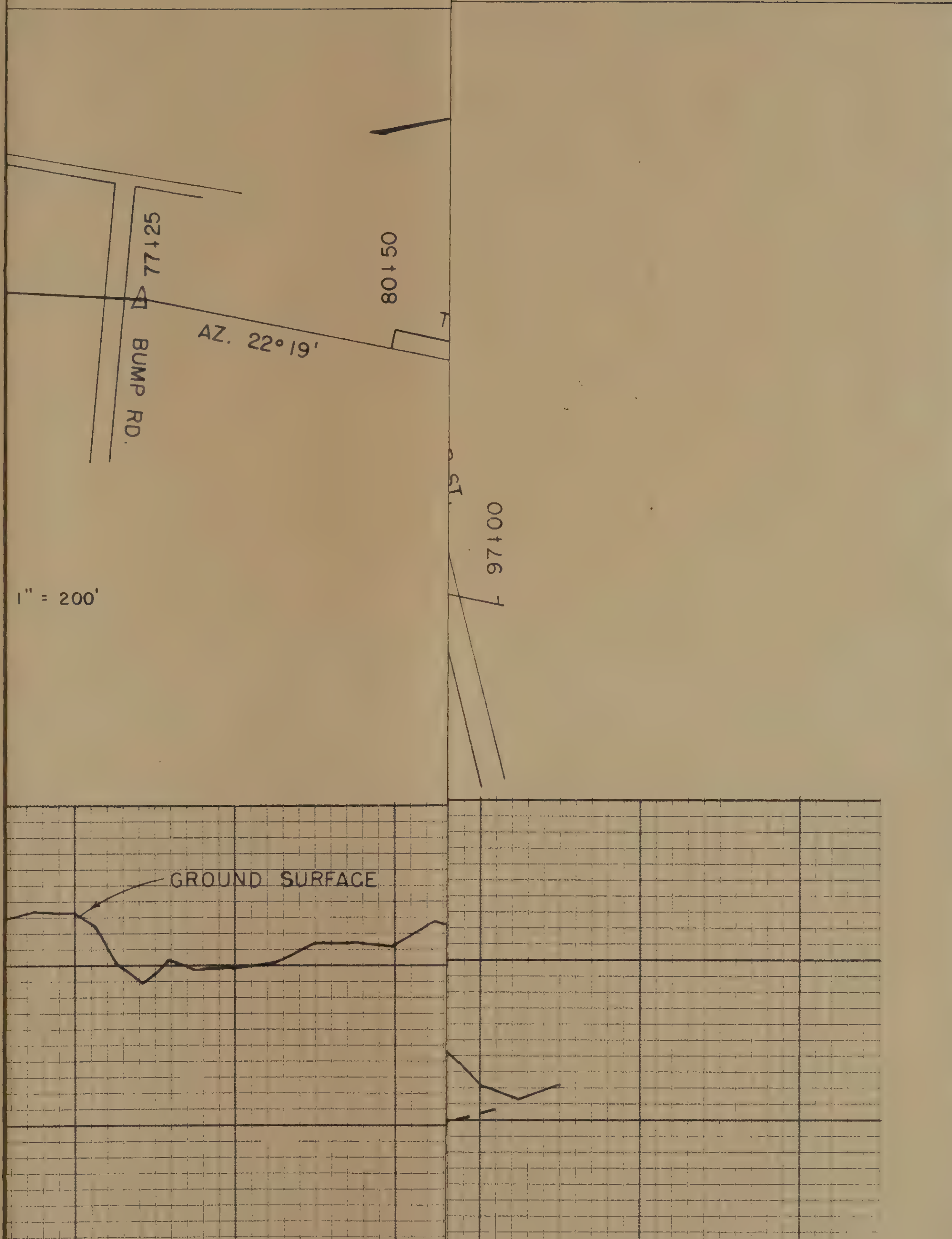
Fig. A-6 Cracked surface of loose fill following several passes of 50-ton roller on natural ground. Test Strip No. 6.

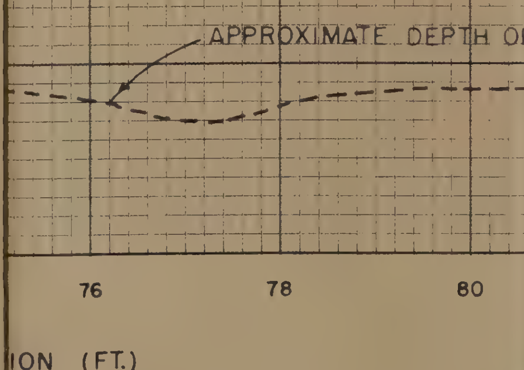
Fig. A-7 Bad depression in turn-around area south of Test Strip No. 3, during rolling with 50-ton roller.

Fig. A-8 Weak foundation in Test Strip No. 7 bogging down 50-ton roller during first pass. No prior rolling given.

Fig. A-9 View of Test Strip No. 7 before rolling. Test Strip No. 1 seen on right.

Fig. A-10 View of Test Strip No. 7 after 5 passes with 50-ton roller. No other rolling given.





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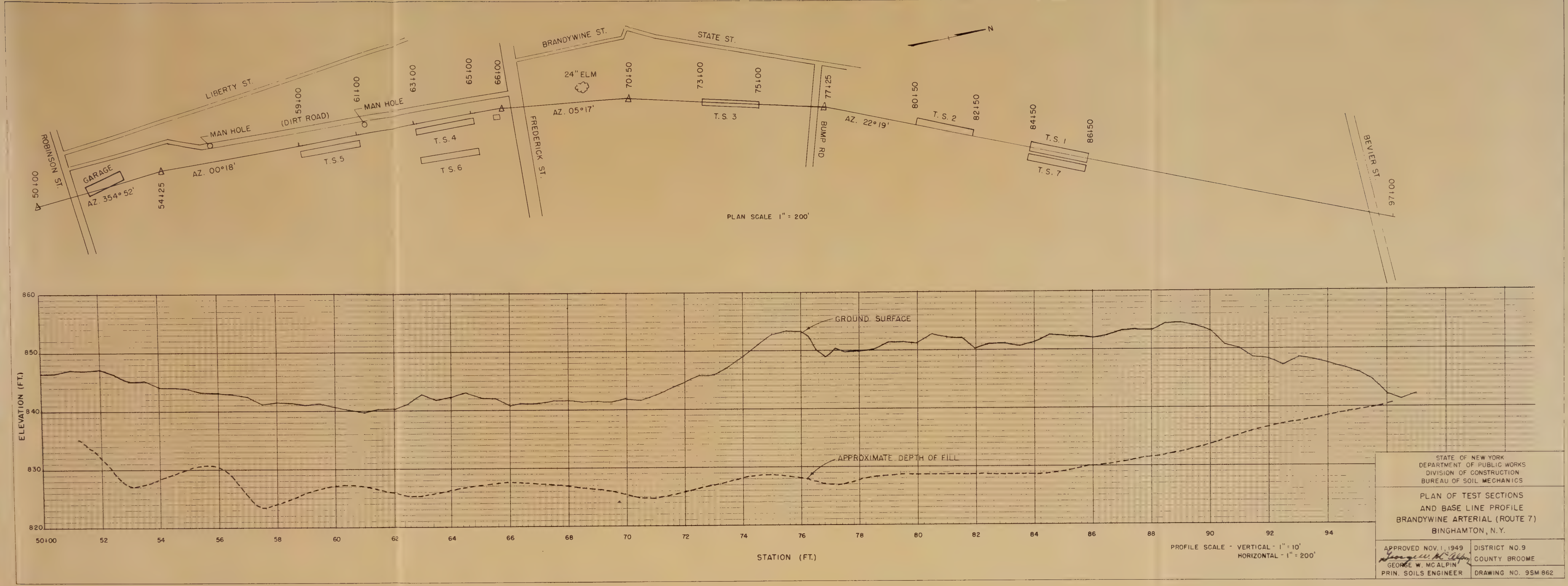
BUREAU OF SOIL MECHANICS

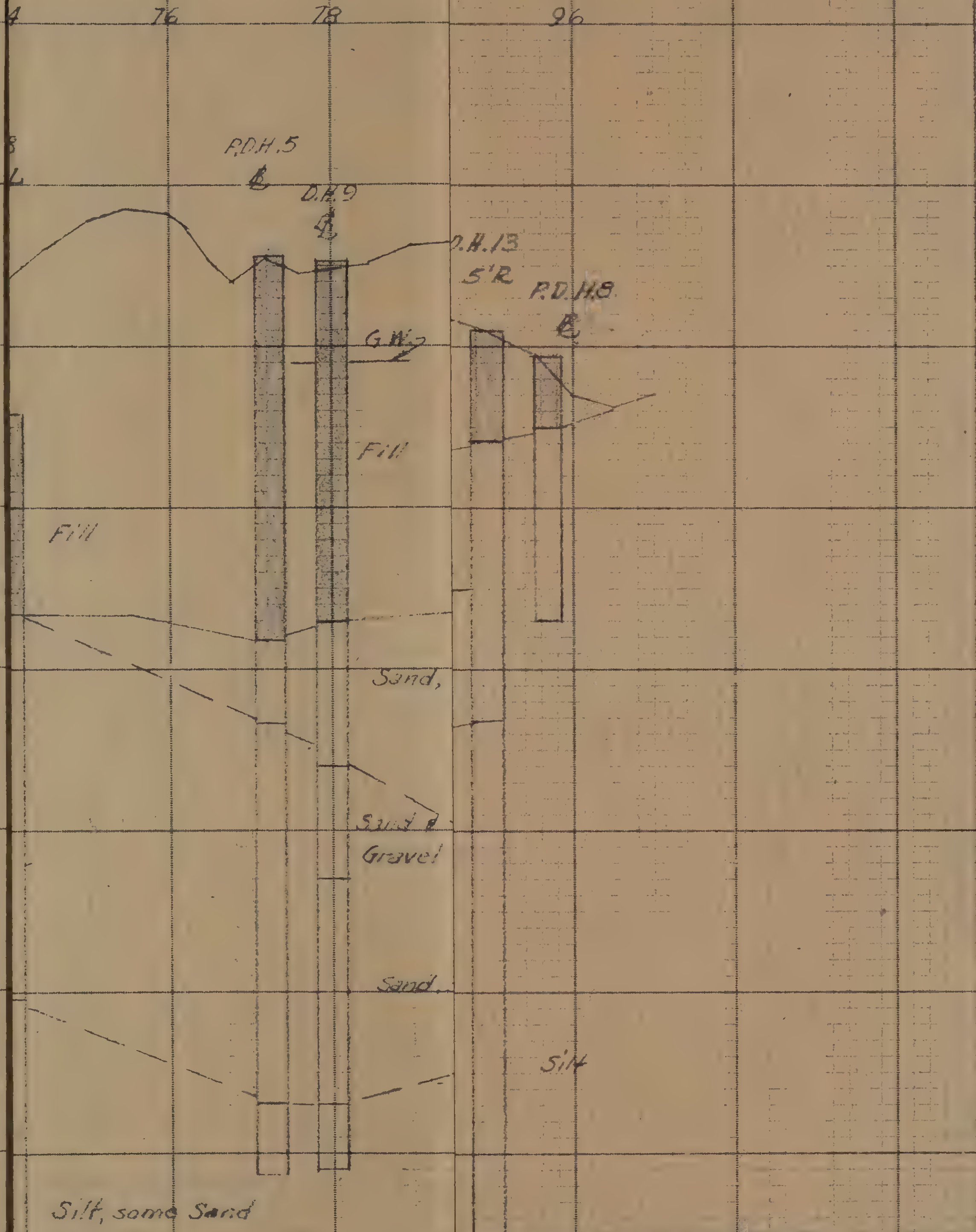
PLAN OF TEST SECTIONS
AND BASE LINE PROFILE
BRANDYWINE ARTERIAL (ROUTE 7)
BINGHAMTON, N.Y.

APPROVED NOV. 1, 1949	DISTRICT NO. 9
George W. McAlpin GEORGE W. MC ALPIN PRIN. SOILS ENGINEER	COUNTY BROOME
	DRAWING NO. 9SM 862



N
LIBERTY ST.
BRANDYWINE ST.
STATE ST.
ROBINSON ST.
FREDERICK ST.
BUMP RD.
BEVIER ST.
GARAGE
MAN HOLE
(DIRT ROAD)
MAN HOLE
24" ELM
50+00
54+25
59+00
61+00
63+00
65+00
66+00
70+50
73+00
75+00
77+25
80+50
82+50
84+50
86+50
97+00
AZ. 354° 52'
AZ. 00°18'
AZ. 05°17'
AZ. 22°19'
T.S. 1
T.S. 2
T.S. 3
T.S. 4
T.S. 5
T.S. 6
T.S. 7
PLAN SCALE 1" = 200'
ELEVATION (FT.)
860
850
840
830
820
GROUND SURFACE
APPROXIMATE DEPTH OF FILL
50+00
52
54
56
58
60
62
64
66
68
70
72
74
76
78
80
82
84
86
88
90
92
94
STATION (FT.)
PROFILE SCALE - VERTICAL - 1" = 10'
HORIZONTAL - 1" = 200'
STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
DIVISION OF CONSTRUCTION
BUREAU OF SOIL MECHANICS
PLAN OF TEST SECTIONS
AND BASE LINE PROFILE
BRANDYWINE ARTERIAL (ROUTE 7)
BINGHAMTON, N.Y.
APPROVED NOV. 1, 1949
George W. McAlpin
GEORGE W. MC ALPIN
PRIN. SOILS ENGINEER
DISTRICT NO. 9
COUNTY BROOME
DRAWING NO. 9SM 862

FIG. A-12



Soil Classification

P.D.H. = Preliminary

D.H. = Exploratory

STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
DIVISION OF CONSTRUCTION
BUREAU OF SOIL MECHANICS

GENERALIZED SOIL PROFILE
FOR BASE LINE STA. 50+00 to 97+00
BRANDYWINE ARTERIAL (ROUTE 11)
BINGHAMTON, N.Y.

APPROVED Nov 23 1949	DISTRICT NO. 9
George W. McAlpin	COUNTY BROOME
	DRAWING NO. 9 SM871

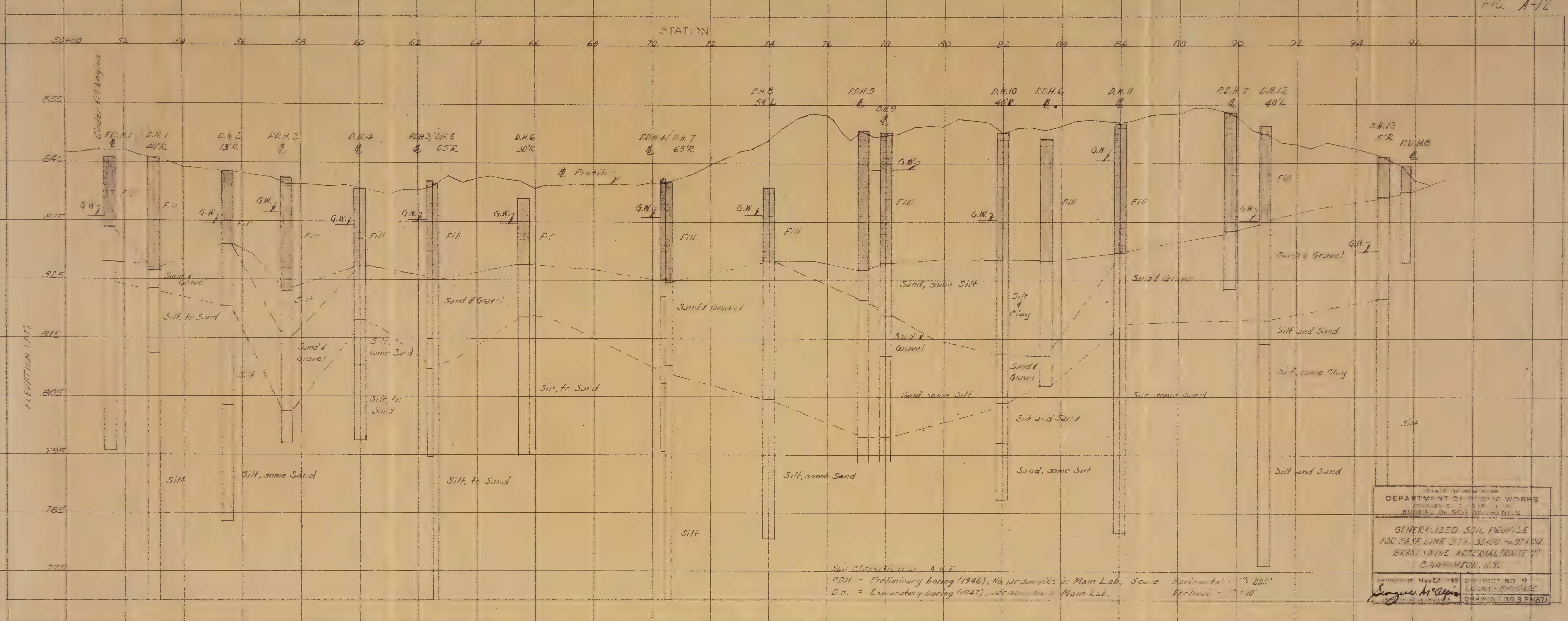


FIG. A-12
STATION
50+00 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 92 94 96
ELEVATION (FT)
845 835 825 815 805 795 785 775
Cinder fill begins
P.D.H.1
D.H.1 40'R
D.H.2 13'R
P.D.H.2
D.H.4
P.D.H.3 / D.H.5 65'R
D.H.6 30'R
P.D.H.4 / D.H.7 65'R
D.H.8 51'L
P.D.H.5
D.H.9
D.H.10 40'R
P.D.H.6
D.H.11
P.D.H.7
D.H.12 40'L
D.H.13 5'R
P.D.H.8
℄ Profile
G.W.
Fill
Sand & Gravel
Silt, tr. Sand
Silt
Silt, some Sand
Sand, some Silt
Silt & Clay
Silt and Sand
Silt, some Clay
Soil Classification A.A.E.
P.D.H. = Preliminary boring (1946), No jar samples in Main Lab.
D.H. = Exploratory boring (1947), Jar samples in Main Lab.
Scale Horizontal - 1" = 200'
Vertical - 1" = 10'
STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
BUREAU OF SOIL MECHANICS
GENERALIZED SOIL PROFILE
FOR BASE LINE STA. 50+00 to 97+00
BRANDYWINE ARTERIAL (ROUTE 7)
BINGHAMTON, N.Y.
APPROVED Nov 23 1949
DISTRICT NO. 9
COUNTY BROOME
DRAWING NO. 9 SM 871

APPENDIX B

FIG. B-1

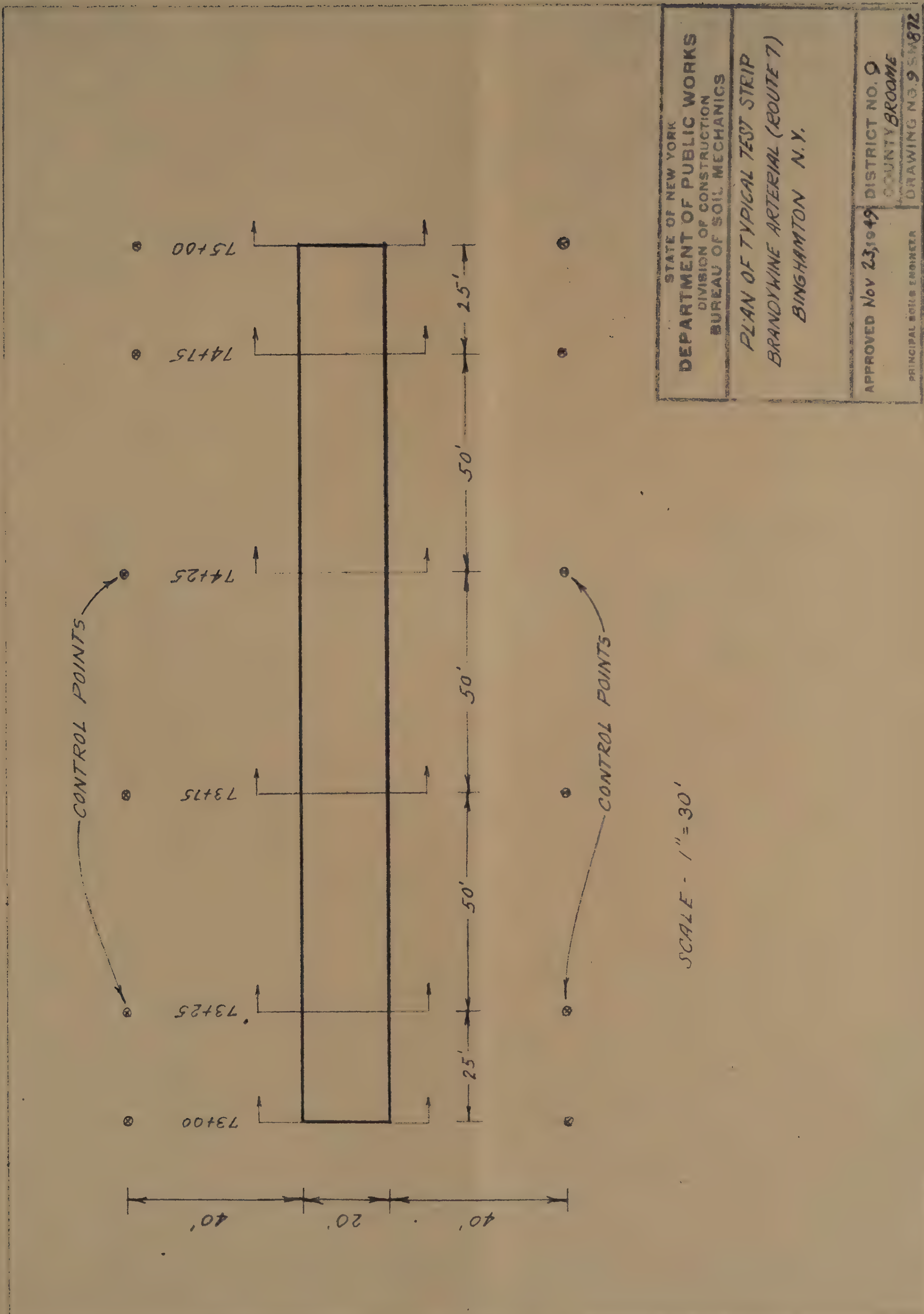

STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
DIVISION OF CONSTRUCTION
BUREAU OF SOIL MECHANICS
PLAN OF TYPICAL TEST STRIP
BRANDYWINE ARTERIAL (ROUTE 7)
BINGHAMTON N.Y.
APPROVED Nov 23, 1949
PRINCIPAL SOILS ENGINEER
DISTRICT NO. 9
COUNTY BROOME
DRAWING NO. 9 SM 872
75+00
74+75
74+25
73+75
73+25
73+00
25'
50'
50'
50'
25'
CONTROL POINTS
CONTROL POINTS
SCALE - 1" = 30'
40'
20'
40'

FIG. B-2

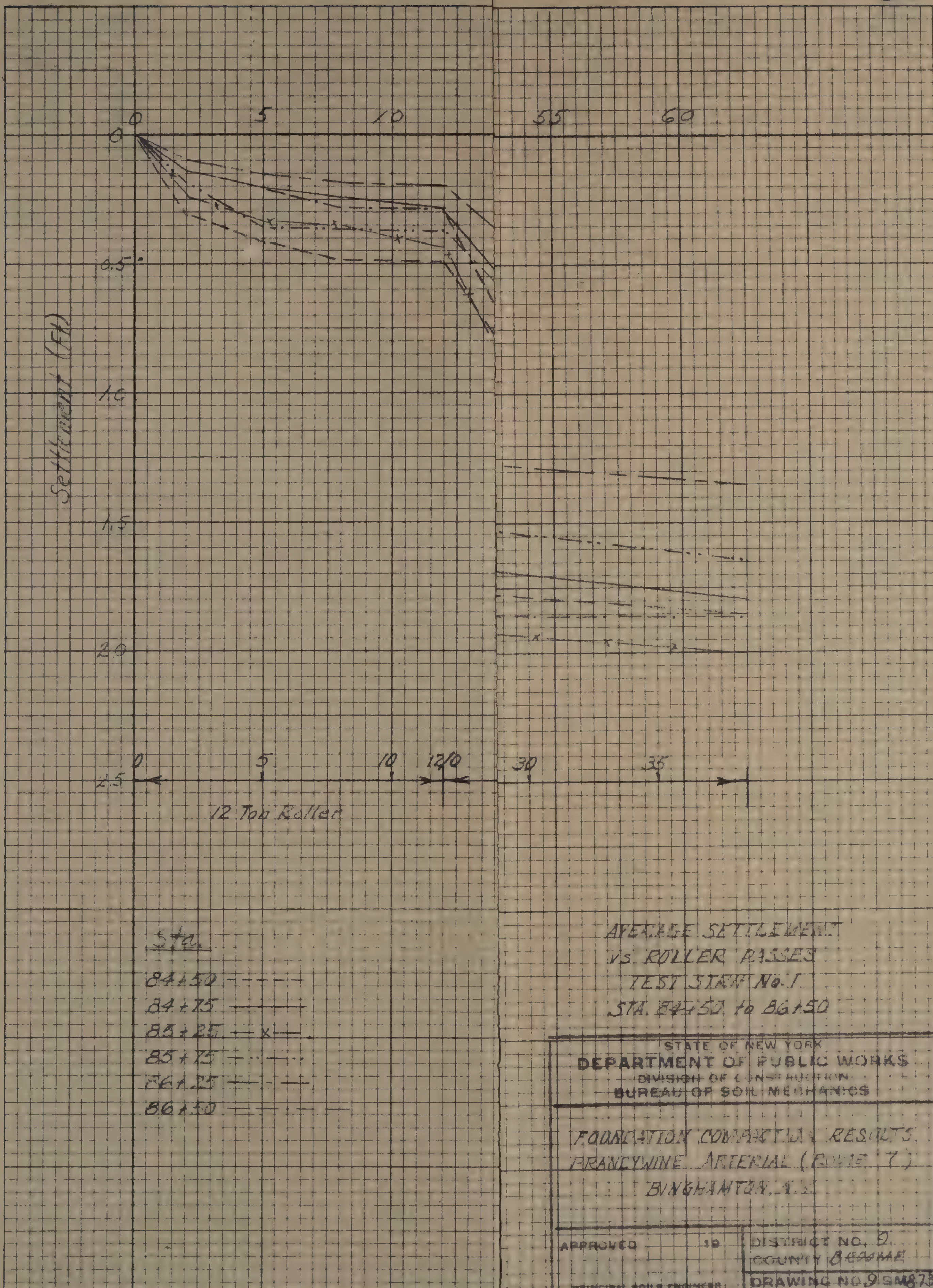

0
5
10
55
60
Settlement (Ft)
0.5
1.0
1.5
2.0
2.5
0
5
10
12/0
30
35
12 Ton Roller
Sta.
84+50
84+75
85+25
85+75
86+25
86+50
AVERAGE SETTLEMENT
vs. ROLLER PASSES
TEST STRIP No. 1
STA. 84+50 to 86+50
STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
DIVISION OF CONSTRUCTION
BUREAU OF SOIL MECHANICS
FOUNDATION COMPACTION RESULTS
BRANDYWINE ARTERIAL
BINGHAMTON
APPROVED
19
DISTRICT NO. 9
COUNTY BROOME
PRINCIPAL SOILS ENGINEER
DRAWING NO. 9 SM873

FIG. B-2

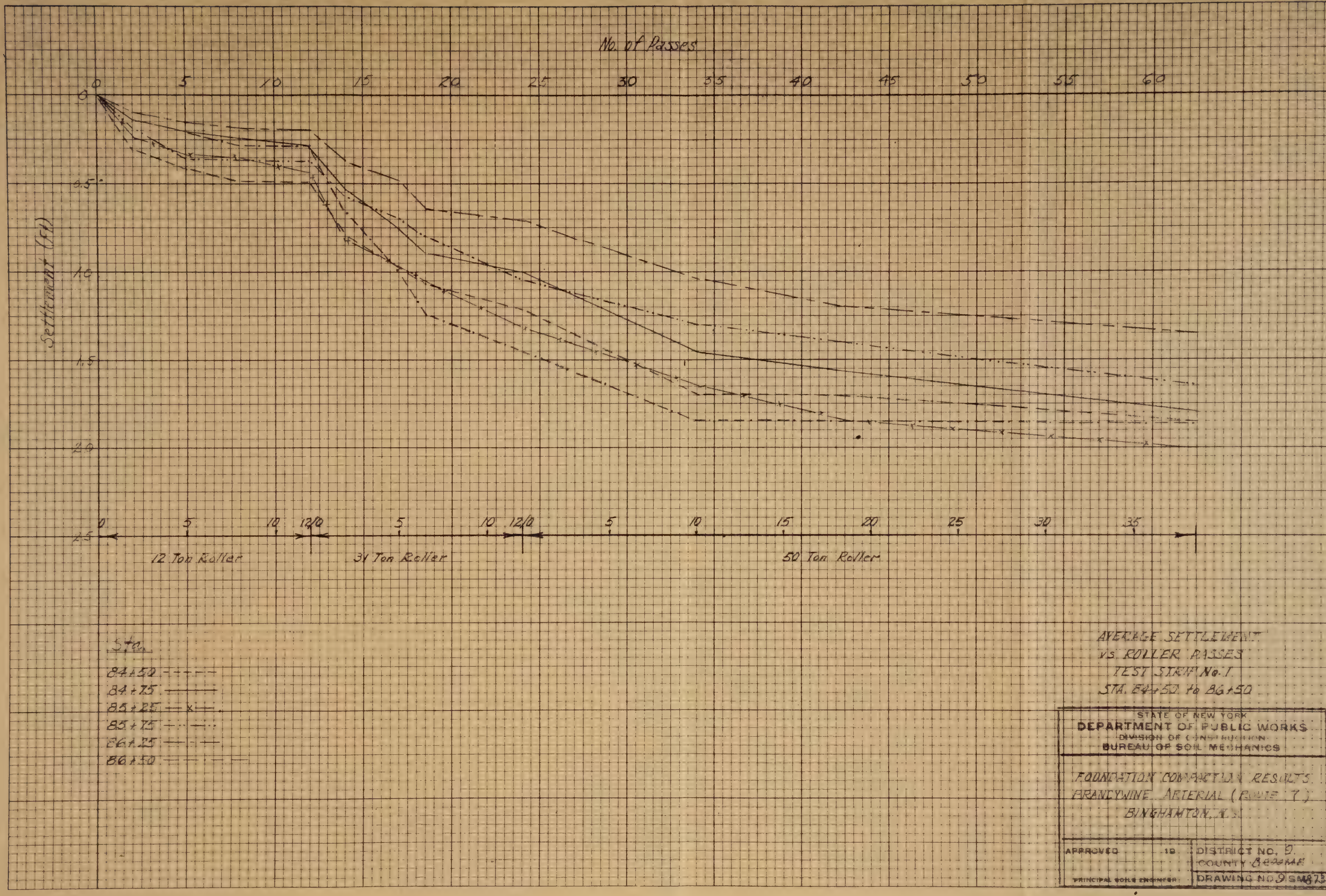
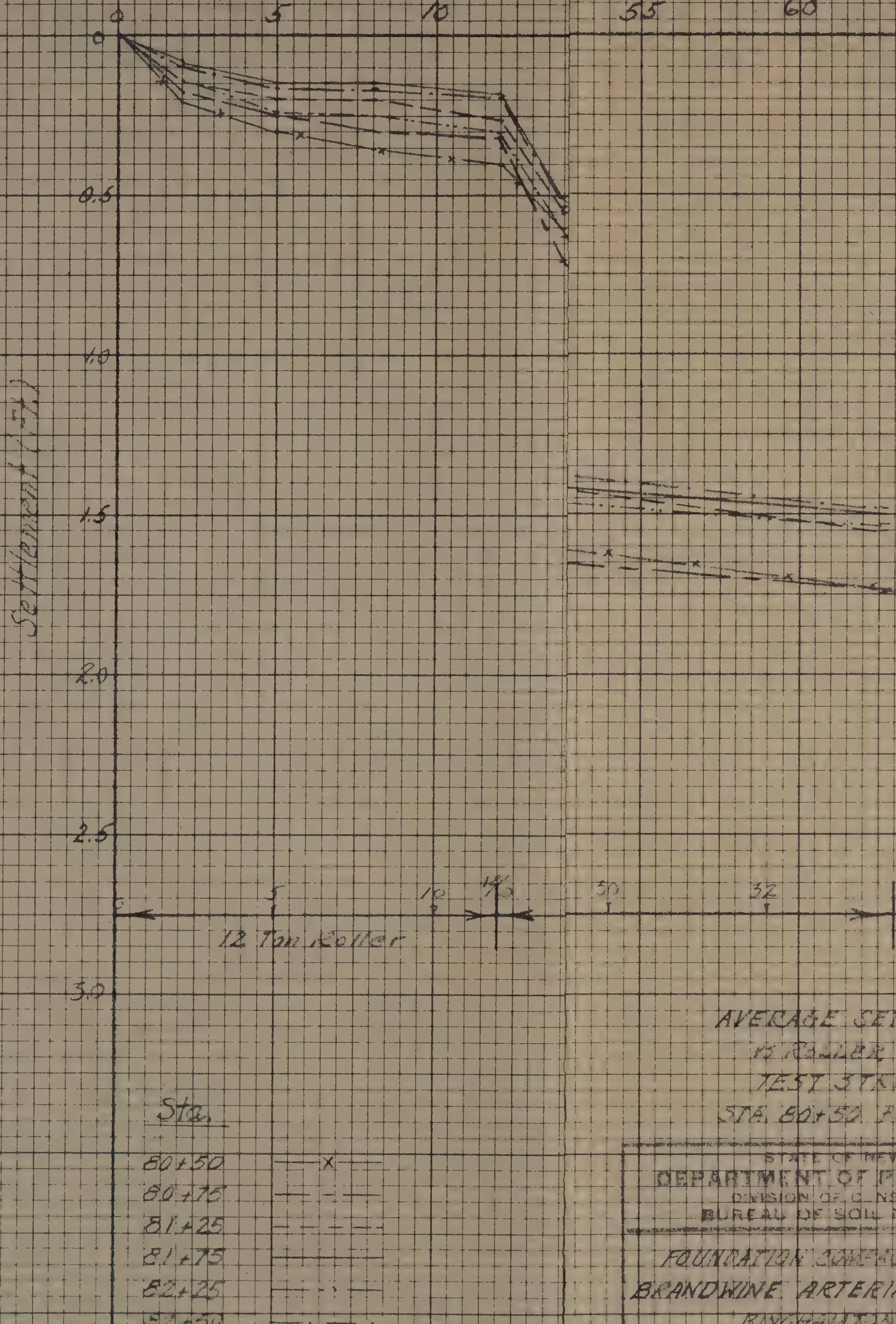

No. of Passes
0
5
10
15
20
25
30
35
40
45
50
55
60
Settlement (Ft)
0
0.5
1.0
1.5
2.0
2.5
0
5
10
12/0
5
10
12/0
5
10
15
20
25
30
35
12 Ton Roller
31 Ton Roller
50 Ton Roller
Sta.
84+50
84+75
85+25
85+75
86+25
86+50
AVERAGE SETTLEMENT
vs ROLLER PASSES
TEST STRIP No. 1
STA. 84+50 to 86+50
STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
DIVISION OF CONSTRUCTION
BUREAU OF SOIL MECHANICS
FOUNDATION COMPACTION RESULTS
BRANDYWINE ARTERIAL (ROUTE 7)
BINGHAMTON, N.Y.
APPROVED 19
PRINCIPAL SOILS ENGINEER
DISTRICT NO. 9
COUNTY BROOME
DRAWING NO. 9 SM873

FIG. B-3



AVERAGE SETTLEMENT

TEST STRIP No. 2

STA. 80+50 TO 82+50

STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
DIVISION OF CONSTRUCTION
BUREAU OF SOIL MECHANICS

BRANDWINE ARTERIAL (ROUTE 7)

APPROVED 19

DISTRICT NO. 9

DRAWING NO. 873

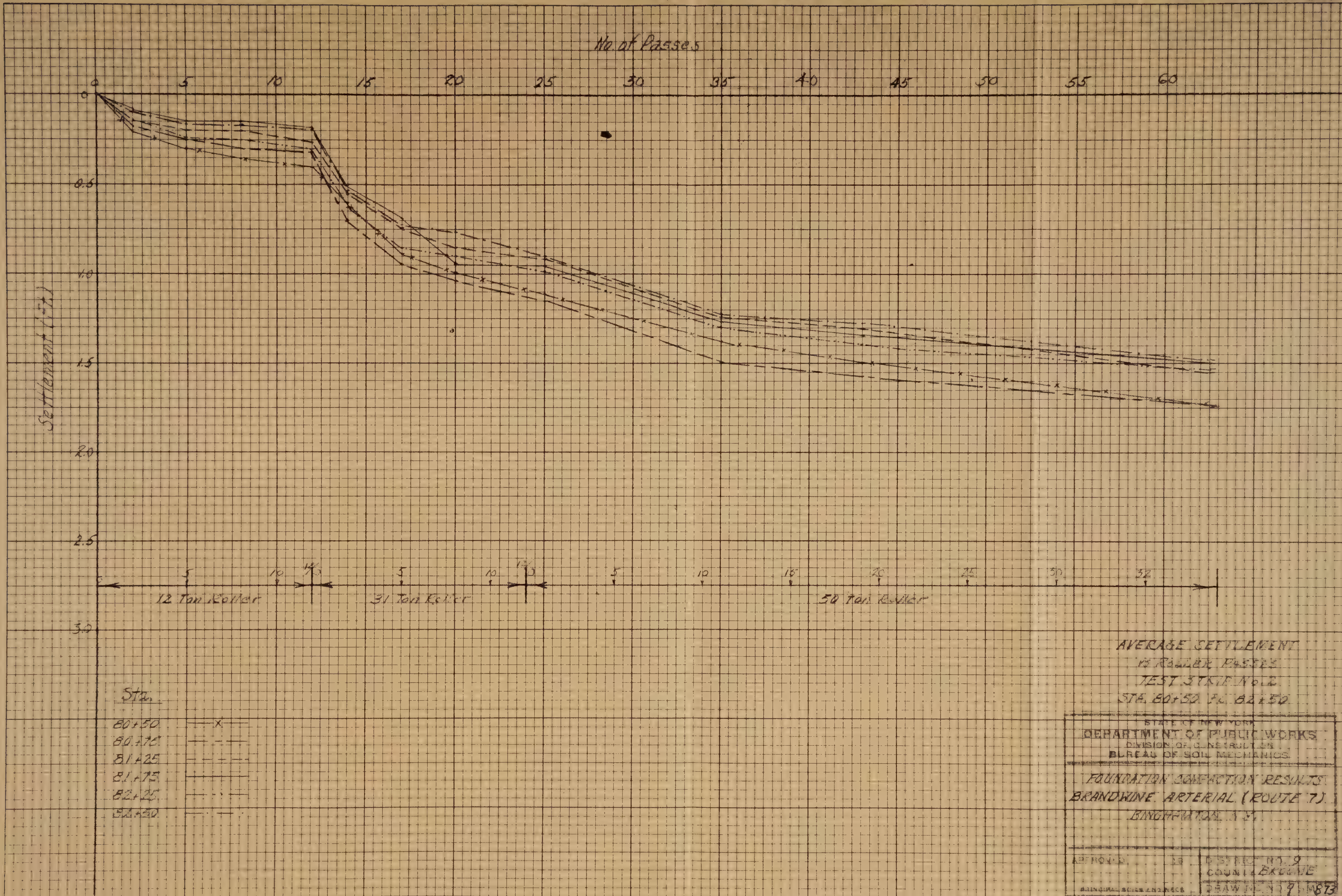
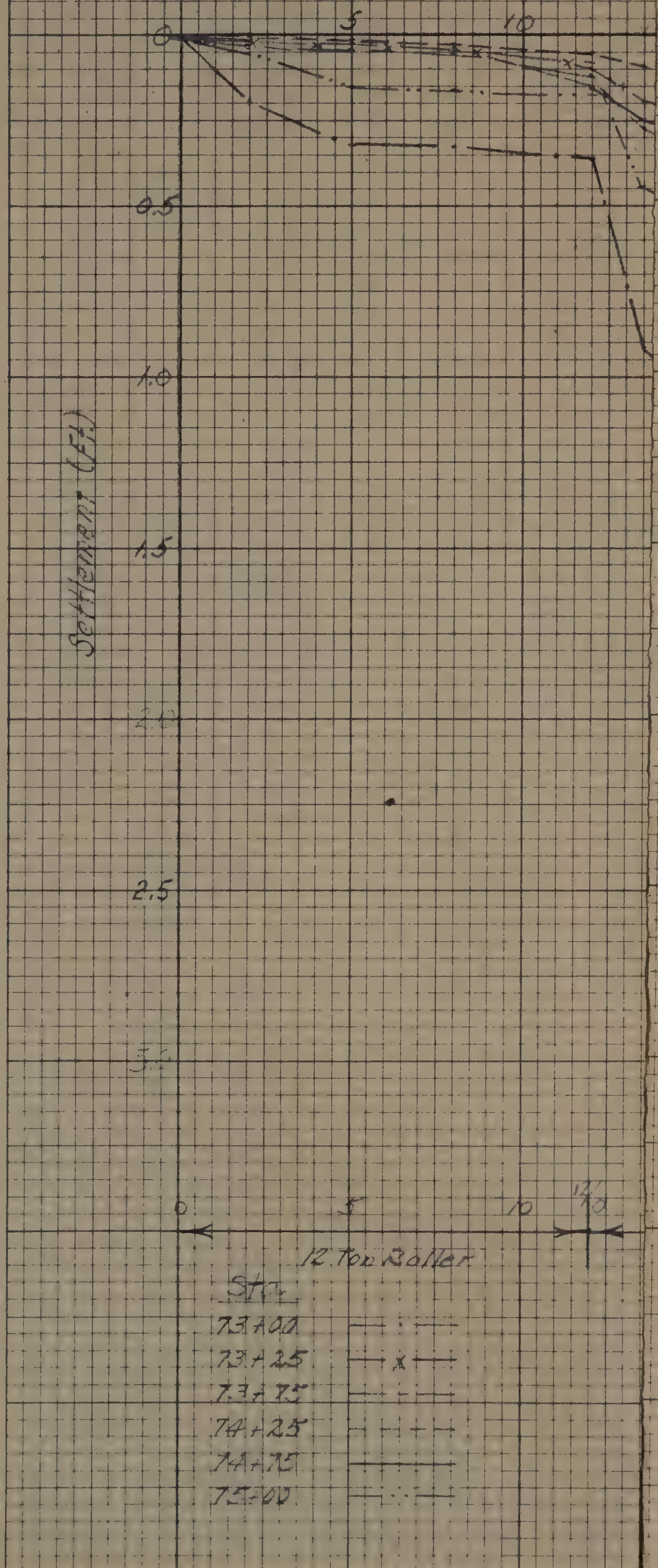

No. of Passes
0
5
10
15
20
25
30
35
40
45
50
55
60
0
0.5
1.0
1.5
2.0
2.5
3.0
Settlement (Ft.)
12 Ton Roller
31 Ton Roller
50 Ton Roller
Sta.
80+50
80+75
81+25
81+75
82+25
82+50
AVERAGE SETTLEMENT
vs ROLLER PASSES
TEST STRIP No. 2
STA. 80+50 to 82+50
STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
DIVISION OF CONSTRUCTION
BUREAU OF SOIL MECHANICS
FOUNDATION COMPACTION RESULTS
BRANDWINE ARTERIAL (ROUTE 7)
BINGHAMTON N.Y.
APPROVED
DISTRICT NO. 9
COUNTY BROOME
DRAWING NO. 9 SM 873

FIG. B-4



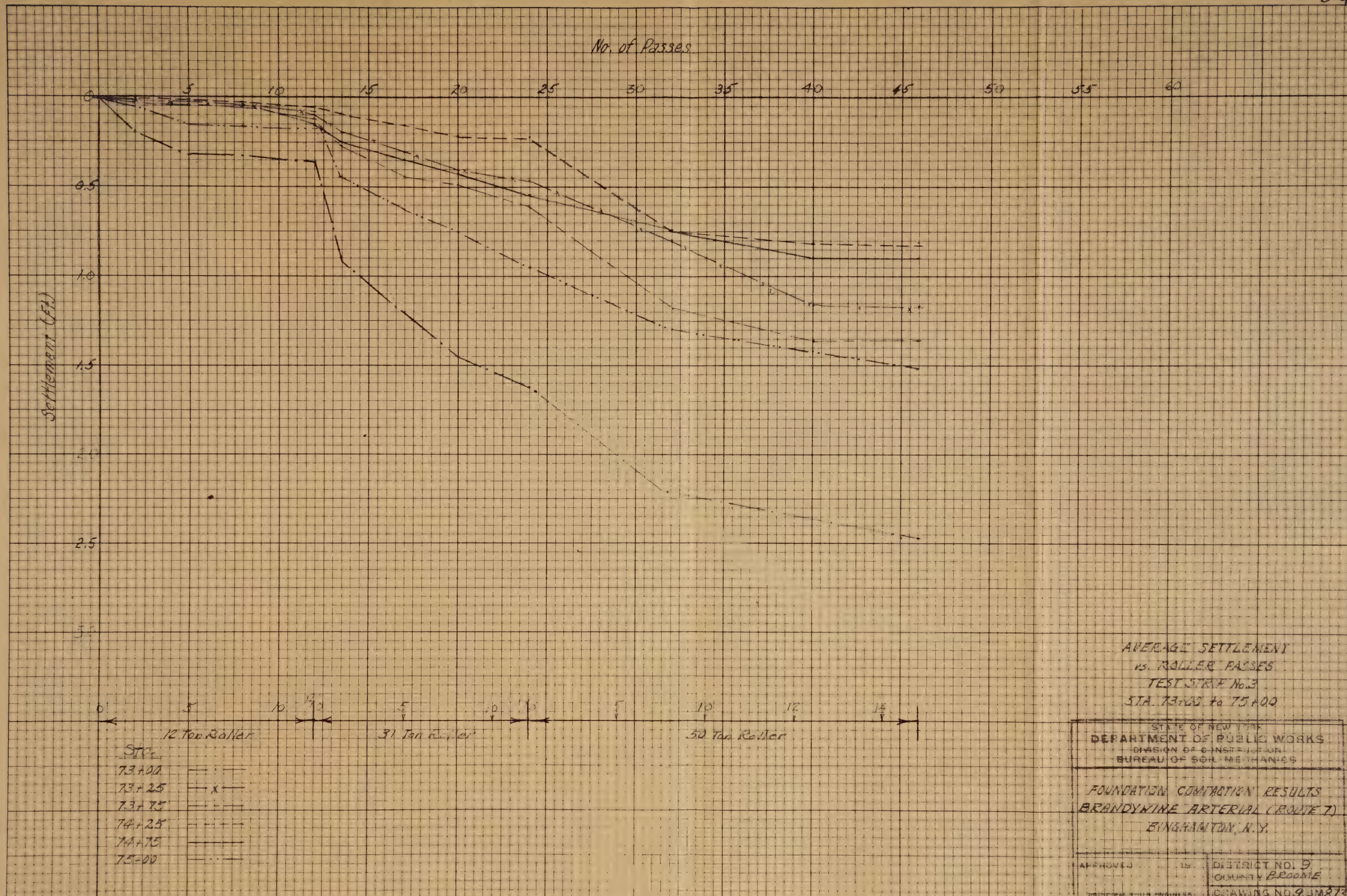
AVERAGE SETTLEMENT
vs. ROLLER PASSES
TEST STRIP No. 3
STA. 73+00 to 75+00

STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
DIVISION OF CONSTRUCTION
BUREAU OF SOIL MECHANICS

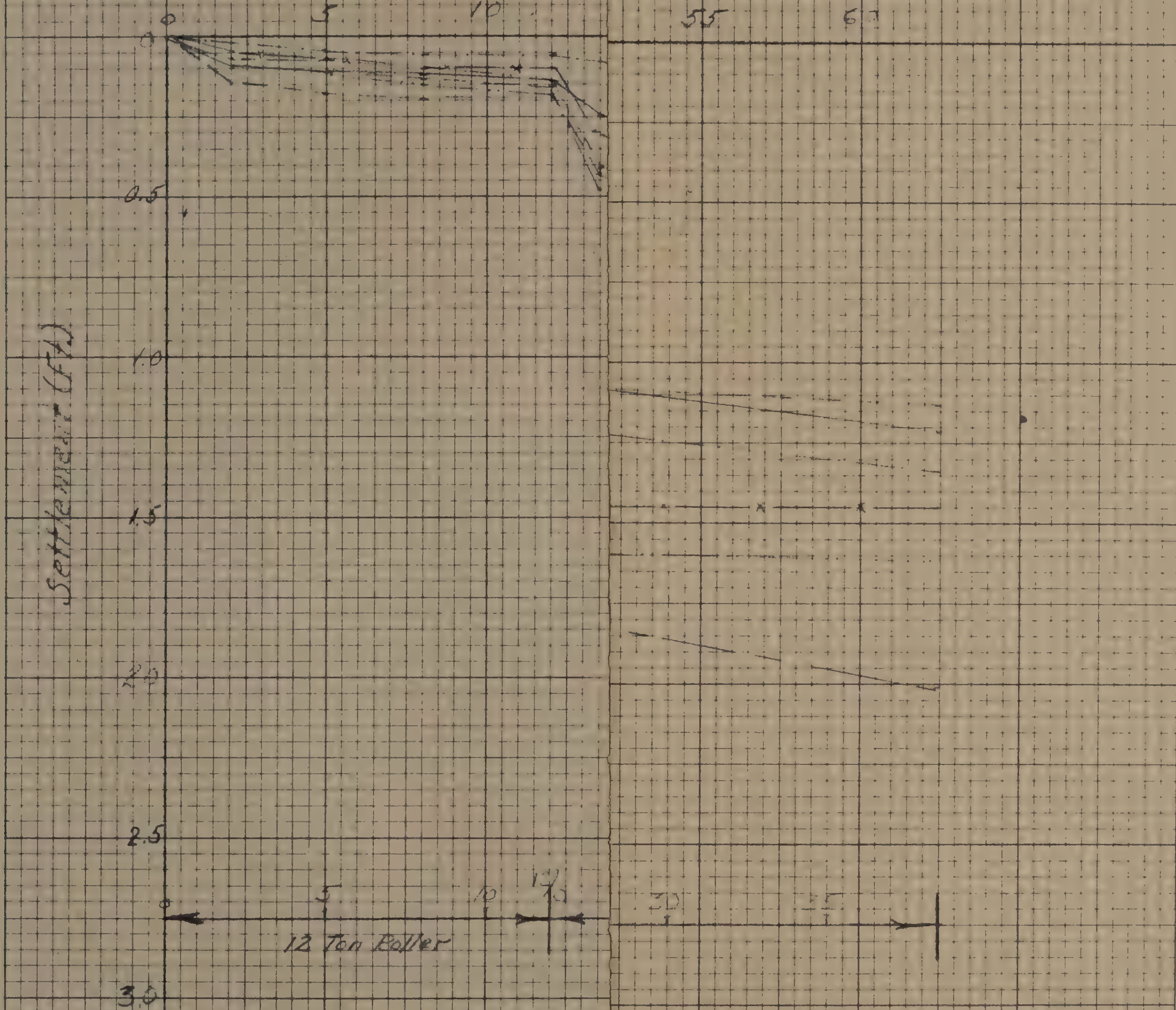
FOUNDATION COMPACTION RESULTS
BRANDYWINE ARTERIAL (ROUTE 7)
BINGHAMTON, N.Y.

APPROVED ... 19 ...	DISTRICT NO. 9
	COUNTY BROOME
PRINCIPAL SOILS ENGINEER	DRAWING NO. 9 SM 973

FIG. B-4



No. of Passes
0
5
10
15
20
25
30
35
40
45
50
55
60
Settlement (Ft.)
0.5
1.0
1.5
2.0
2.5
3.0
12 Ton Roller
31 Ton Roller
50 Ton Roller
Sta.
73+00
73+25
73+75
74+25
74+75
75+00
AVERAGE SETTLEMENT
vs. ROLLER PASSES
TEST STRIP No. 3
STA. 73+00 to 75+00
STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
BUREAU OF SOIL MECHANICS
FOUNDATION COMPACTION RESULTS
BRANDYWINE ARTERIAL (ROUTE 7)
BINGHAMTON, N.Y.
DISTRICT NO. 9
COUNTY BROOME
DRAWING NO. 9 SM 873



Sta.
63+00
63+25
63+75
64+25
64+75
65+00

AVERAGE SETTLEMENT
vs ROLLER PASSES
TEST STRIP No. 4
STA. 63+00 to 65+00

STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
DIVISION OF CONSTRUCTION
BUREAU OF SOIL MECHANICS

FOUNDATION COMPACTION RESULTS
BRANDYWINE ARTERIAL (ROUTE 7)
BINGHAMTON, N.Y.

APPROVED
PRINCIPAL SOILS ENGINEER
DISTRICT NO. 9
COUNTY BROOME
DRAWING NO. 7 SM 873

B-5

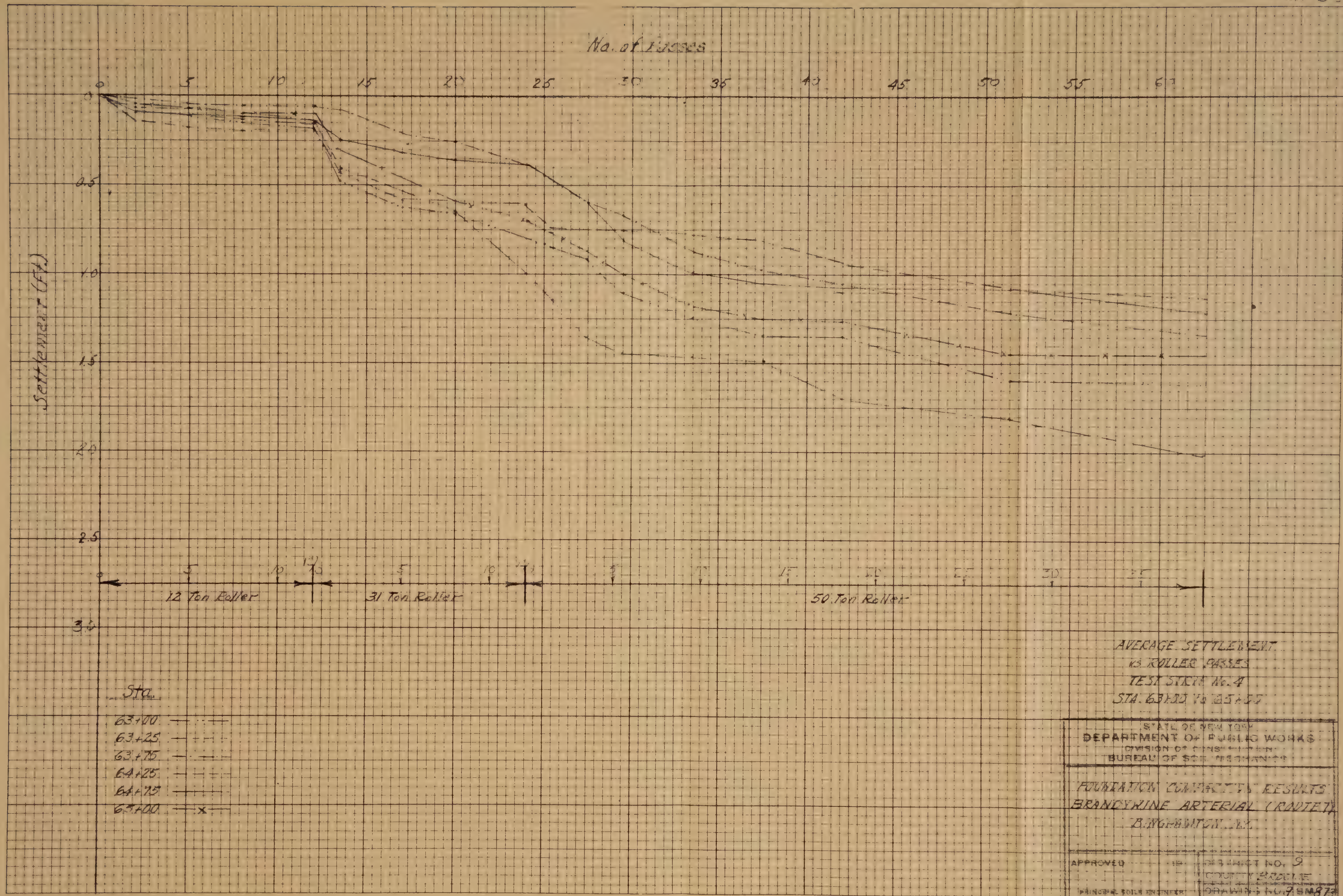

No. of Passes
Settlement (Ft.)
12 Ton Roller
31 Ton Roller
50 Ton Roller
Sta.
63+00
63+25
63+75
64+25
64+75
65+00
AVERAGE SETTLEMENT
vs. ROLLER PASSES
TEST STRIP No. 4
DEPARTMENT OF PUBLIC WORKS
BRANDYWINE ARTERIAL
APPROVED
PRINCIPAL SOILS ENGINEER
DISTRICT NO. 9

Fig. B-6

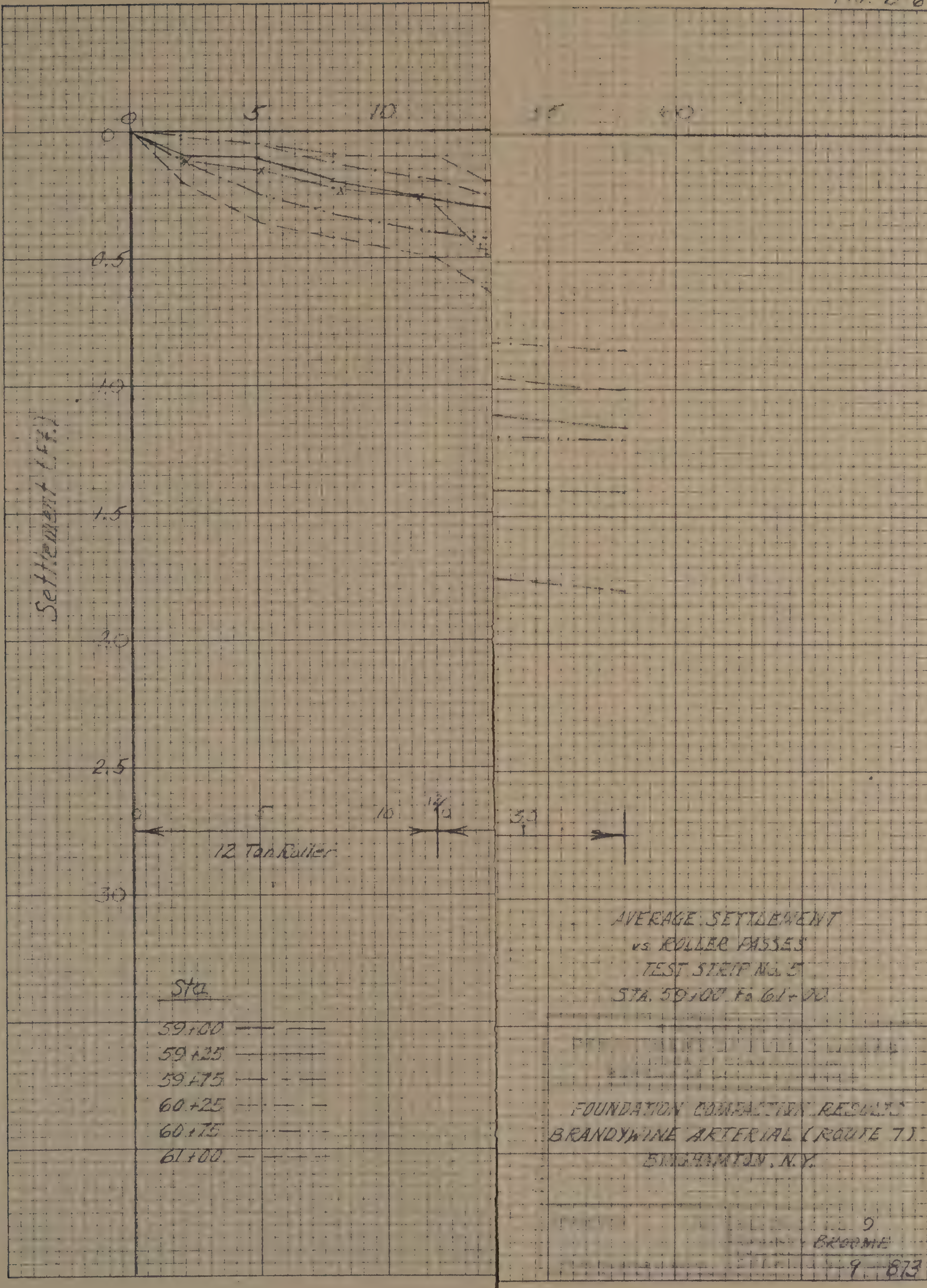
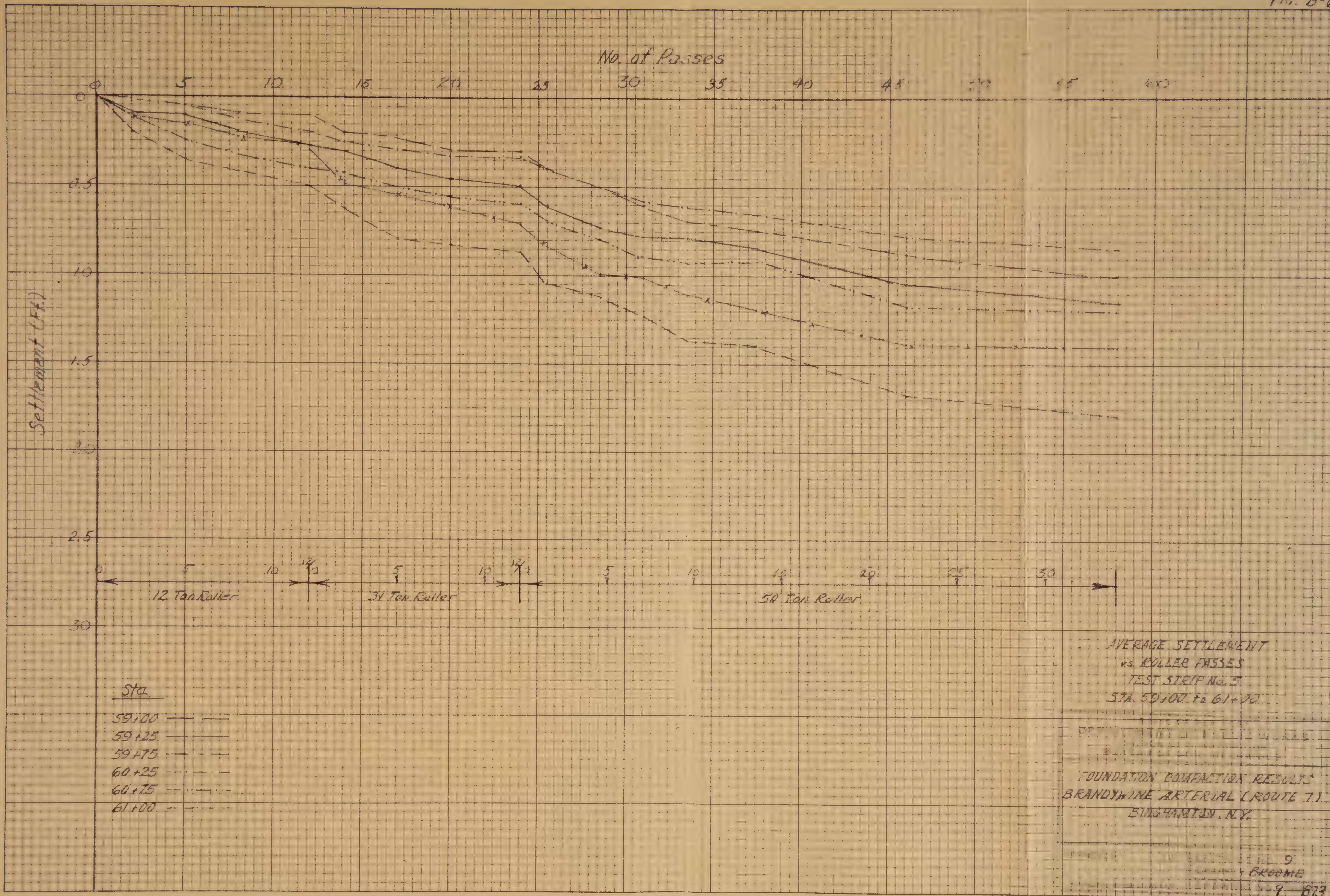
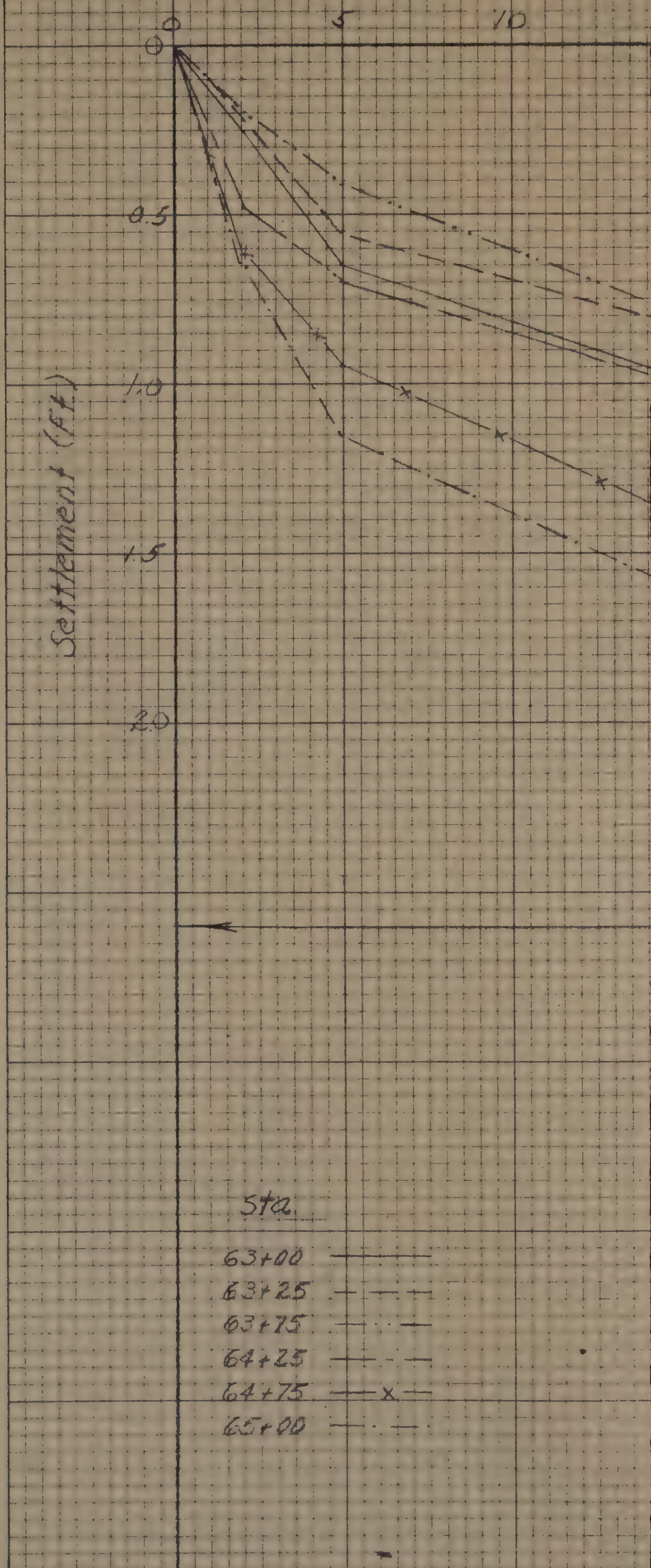

0
5
10
15
20
0
0.5
1.0
1.5
2.0
2.5
3.0
Settlement (Ft.)
0
5
10
12
30
12 Ton Roller
Sta.
59+00
59+25
59+75
60+25
60+75
61+00
AVERAGE SETTLEMENT
vs. ROLLER PASSES
TEST STRIP No. 5
STA. 59+00 to 61+00
FOUNDATION COMPACTION RESULTS
BRANDYWINE ARTERIAL (ROUTE 7)
BINGHAMTON, N.Y.
9
BROOME
9-6-73

Fig. B-6



No. of Passes
0
5
10
15
20
25
30
35
40
45
Settlement (Ft.)
0
0.5
1.0
1.5
2.0
2.5
3.0
12 Ton Roller
31 Ton Roller
50 Ton Roller
Sta.
59+00
59+25
59+75
60+25
60+75
61+00
AVERAGE SETTLEMENT
vs. ROLLER PASSES
TEST STRIP No. 5
STA. 59+00 to 61+00
FOUNDATION COMPACTION RESULTS
BRANDYWINE ARTERIAL (ROUTE 7)
BINGHAMTON, N.Y.
9
BROOME
9 - 673

FIG. B-7



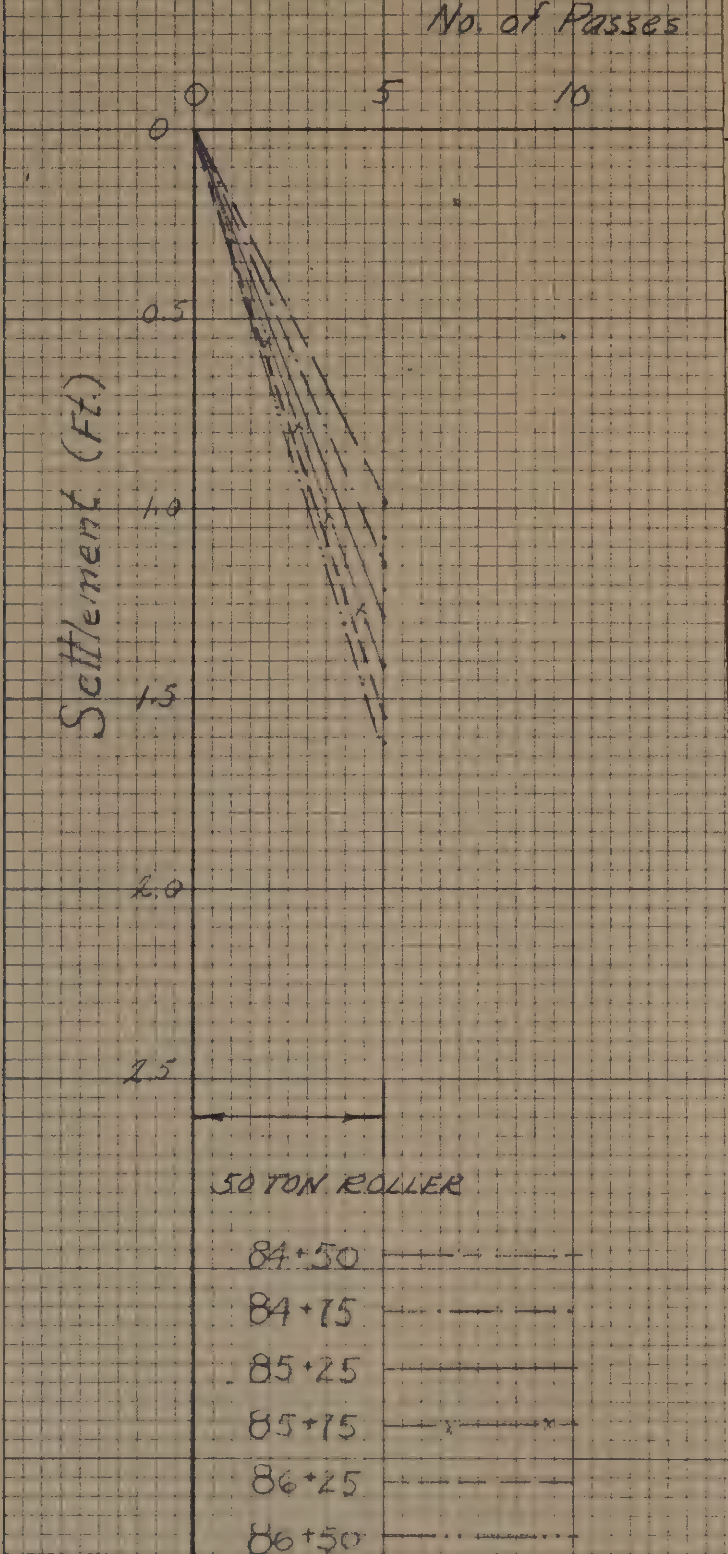
AVERAGE SETTLEMENT
vs ROLLER PASSES
TEST STRIP No. 6
STA. 63+00 to 65+00

FOUNDATION COMPACTION RESULTS
BRANDYWINE ARTERIAL (ROUTE 7)
BINGHAMTON, N.Y.

FIG. B-7

No. of Passes
0
5
10
15
20
25
30
35
40
45
50
55
60
Settlement (Ft.)
0
0.5
1.0
1.5
2.0
50 Ton Roller
Sta.
63+00
63+25
63+75
64+25
64+75
65+00
AVERAGE SETTLEMENT
vs ROLLER PASSES
TEST STRIP No. 6
STA. 63+00 to 65+00
DEPARTMENT OF PUBLIC WORKS
BUREAU OF SOIL MECHANICS
FOUNDATION COMPACTION RESULTS
BRANDYWINE ARTERIAL (ROUTE 7)
BINGHAMTON, N.Y.

FIG. B-8



AVERAGE SETTLEMENT
VS. ROLLER PASSES
TEST STRIP NO. 7
STA. 84+50 TO 86+50

FOUNDATION COMPACTION RESULTS
BRANDYWINE ARTERIAL (ROUTE 7)
BINGHAMTON, N.Y.

9
BROOME
9-873

KEUFFEL & ESSER CO., N. Y. NO 359T-5LG
10 X 10 to the Inch.
MADE IN U.S.A.

FIG. B-8

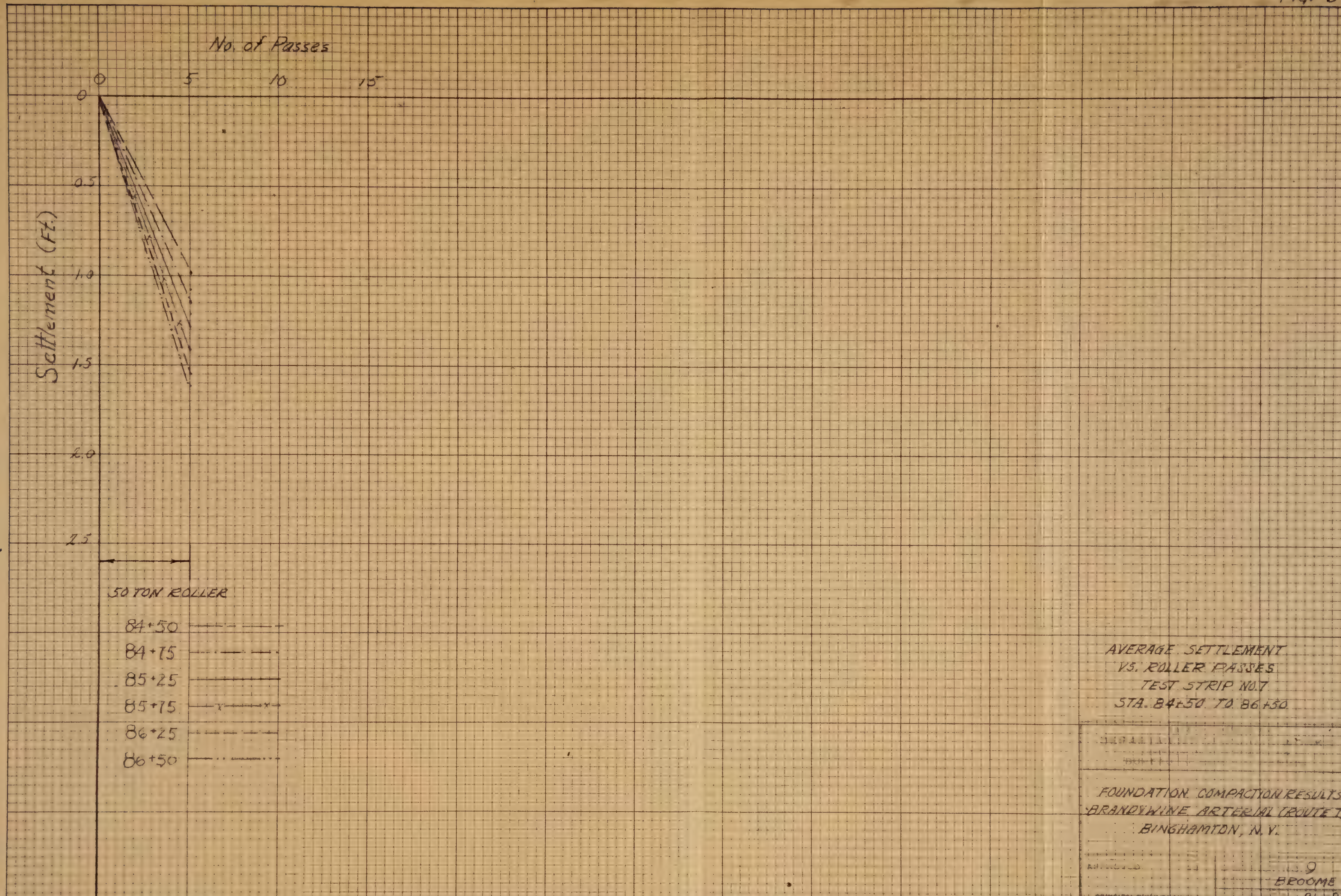

No. of Passes
0
5
10
15
Settlement (Ft.)
0
0.5
1.0
1.5
2.0
2.5
50 TON ROLLER
84+50
84+75
85+25
85+75
86+25
86+50
AVERAGE SETTLEMENT
VS. ROLLER PASSES
TEST STRIP NO. 7
STA. 84+50 TO 86+50
FOUNDATION COMPACTION RESULTS
BRANDYWINE ARTERIAL (ROUTE 7)
BINGHAMTON, N.Y.
9
BROOME
9-873

FIG. B-9

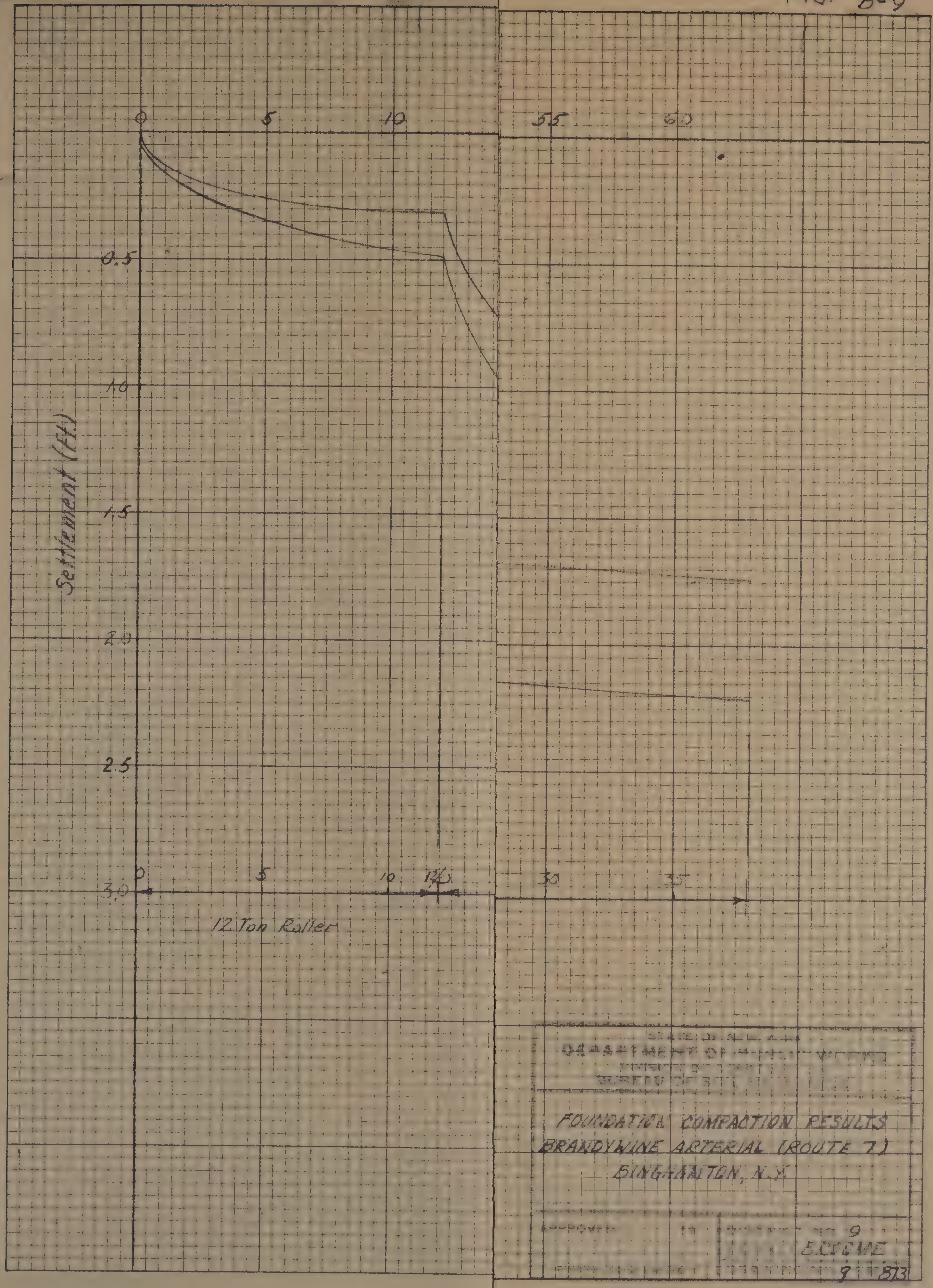

0
5
10
55
60
0.5
1.0
1.5
2.0
2.5
3.0
Settlement (Ft.)
12
30
35
12 Ton Roller
FOUNDATION COMPACTION RESULTS
BRANDYWINE ARTERIAL (ROUTE 7)
BINGHAMTON, N.Y.
9
873

FIG. B-9

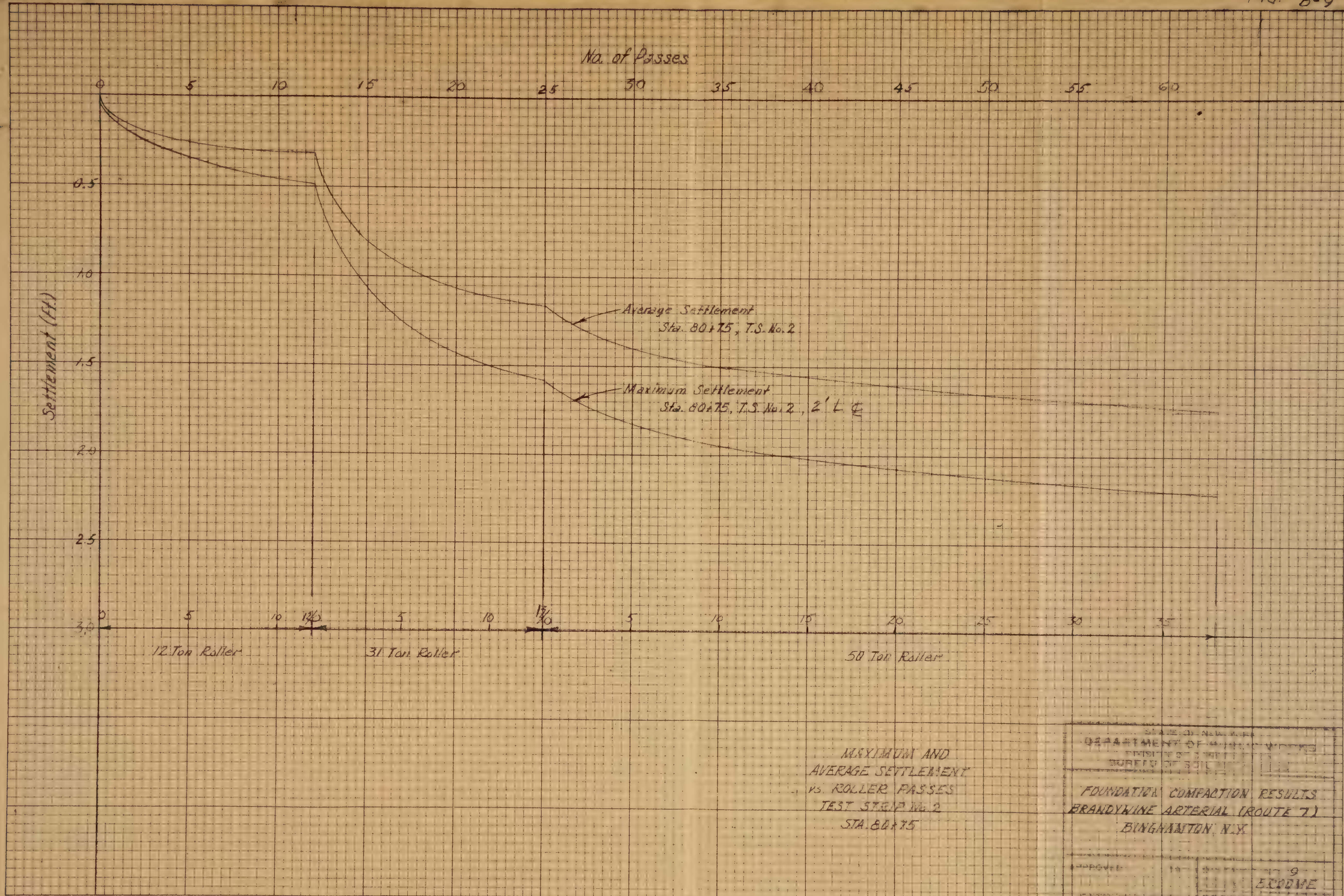
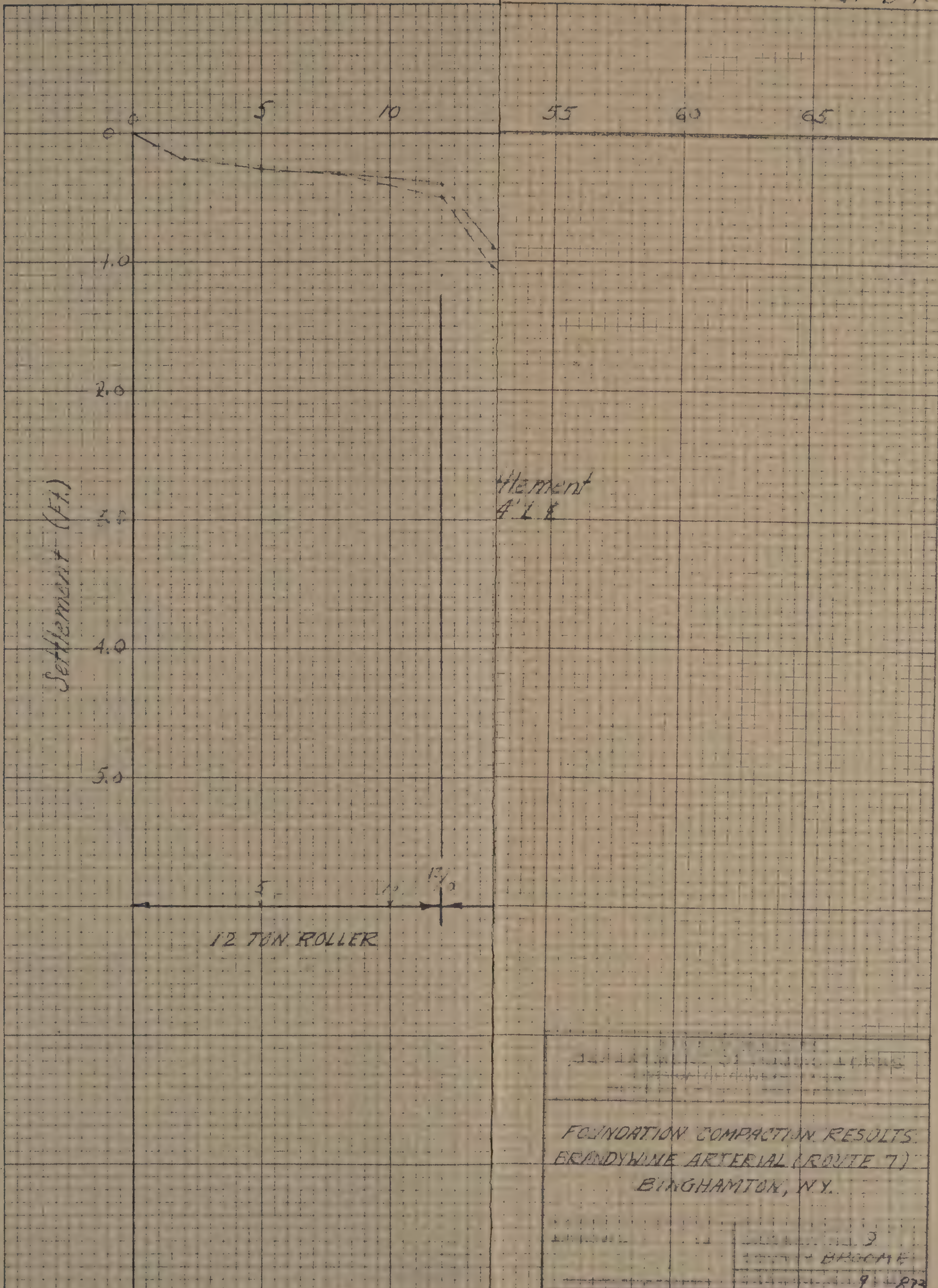
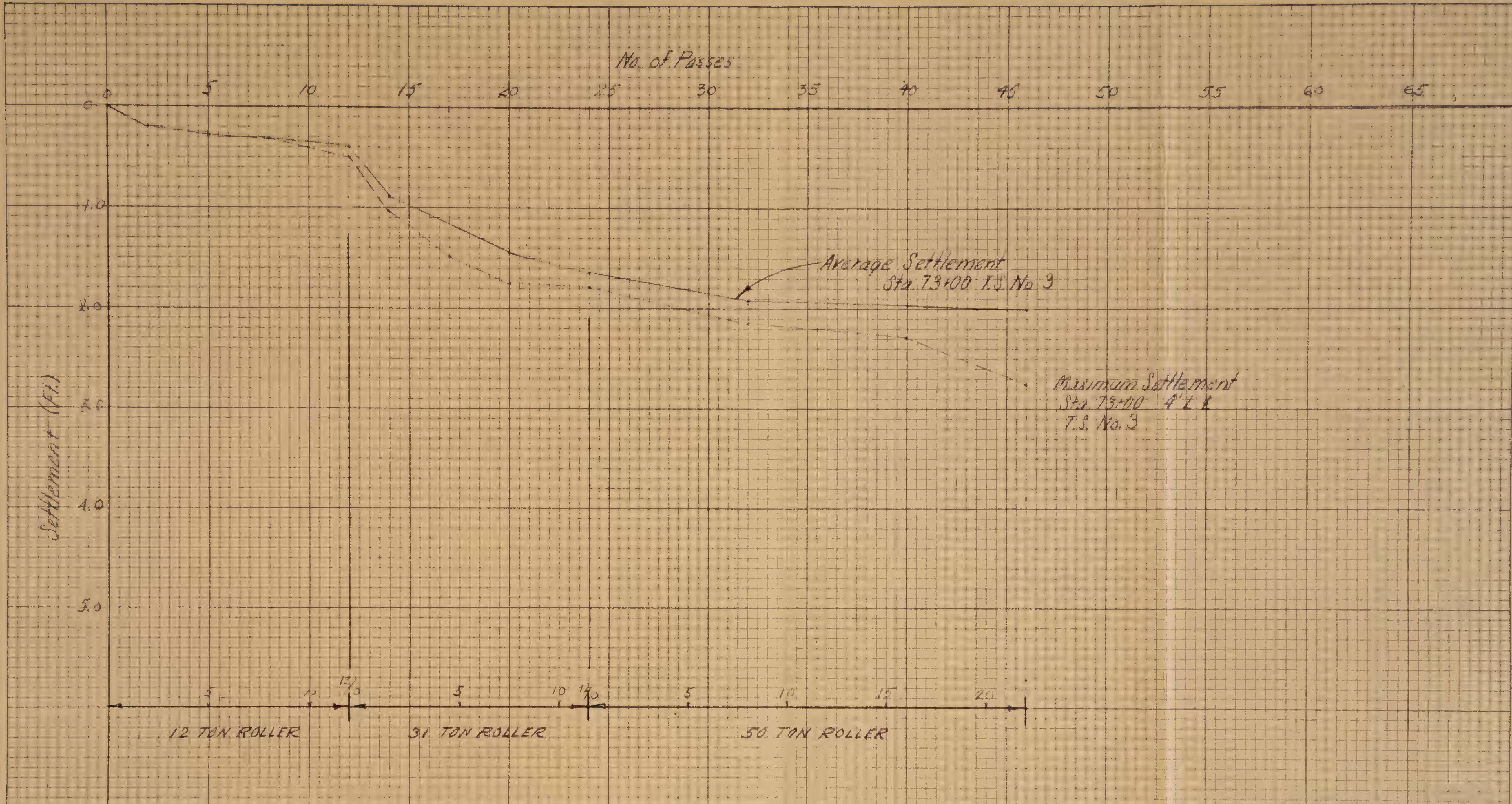

No. of Passes
0
5
10
15
20
25
30
35
40
45
50
55
60
Settlement (Ft.)
0.5
1.0
1.5
2.0
2.5
3.0
Average Settlement
Sta. 80+75, T.S. No. 2
Maximum Settlement
Sta. 80+75, T.S. No. 2, 2' L ℄
12 Ton Roller
31 Ton Roller
50 Ton Roller
MAXIMUM AND
AVERAGE SETTLEMENT
vs. ROLLER PASSES
TEST STRIP No. 2
STA. 80+75
FOUNDATION COMPACTION RESULTS
BRANDYWINE ARTERIAL (ROUTE 7)
BINGHAMTON, N.Y.
BROOME
9 813

Fig. B-10



FOUNDATION COMPACTION RESULTS
BRANDYWINE ARTERIAL (ROUTE 7)
BINGHAMTON, N.Y.

Fig. B-10

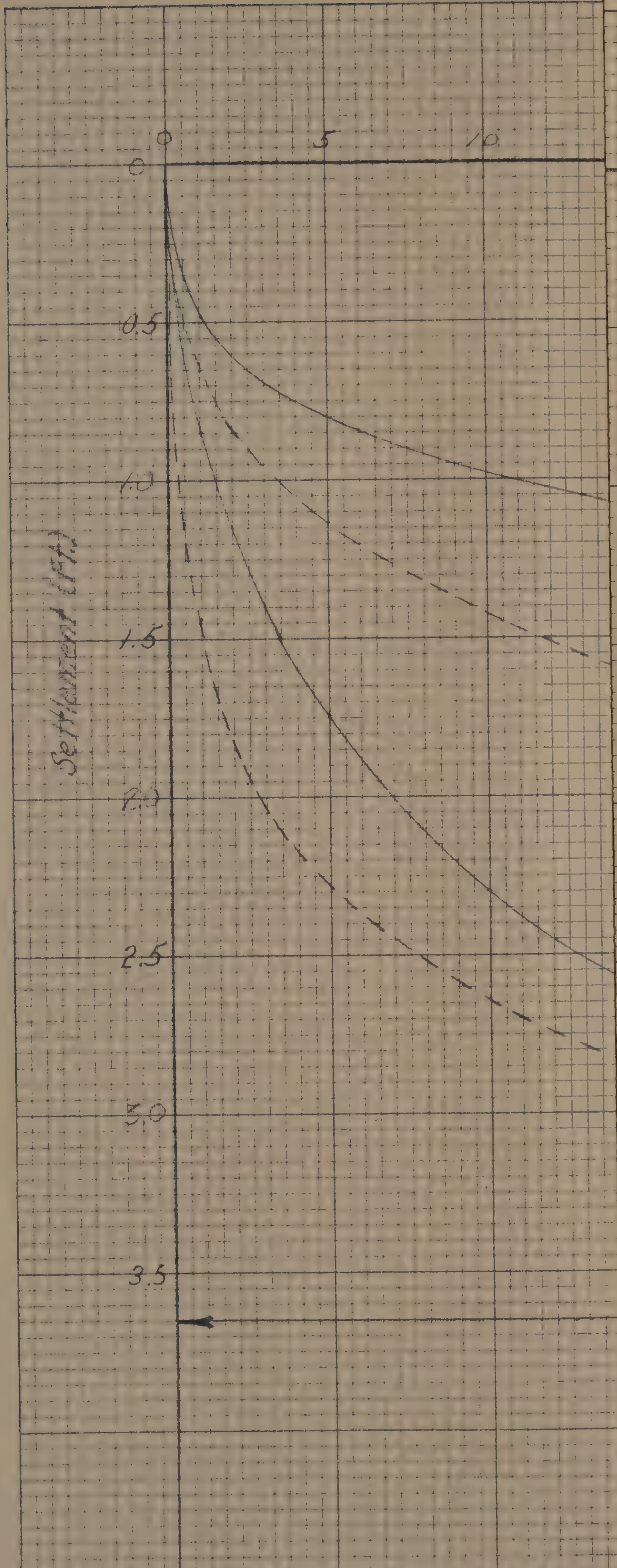


MAXIMUM AND
AVERAGE SETTLEMENT
VS. ROLLER PASSES
TEST STRIP NO. 3
STA. 73+00

FOUNDATION COMPACTION RESULTS
BRANDYWINE ARTERIAL (ROUTE 7)
BINGHAMTON, N.Y.

BROOME
9 873

FIG. B-11



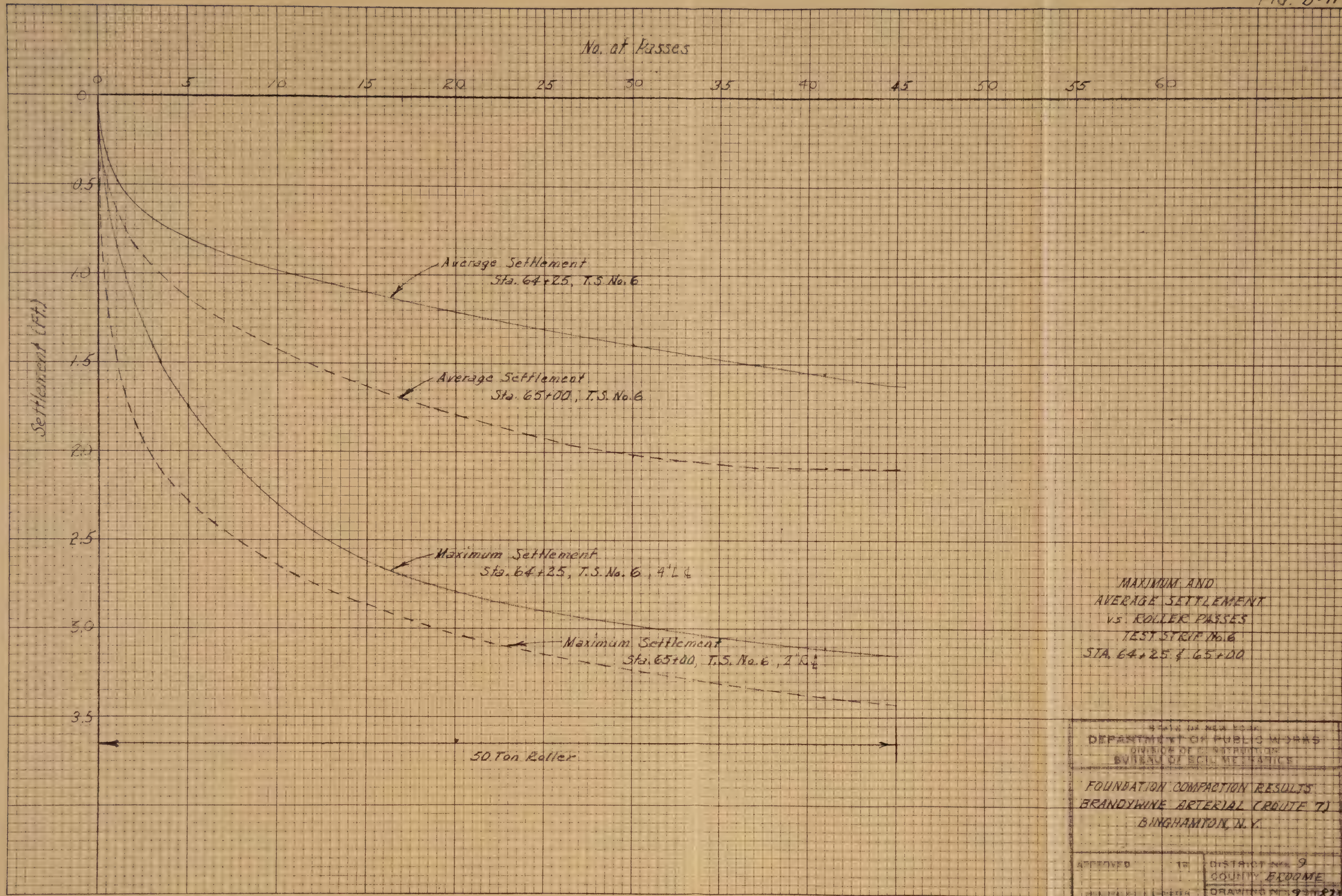
MAXIMUM AND
AVERAGE SETTLEMENT
vs ROLLER PASSES
TEST STRIP No. 6
STA. 64+25 & 65+00

STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
DIVISION OF CONSTRUCTION
BUREAU OF SOIL MECHANICS

FOUNDATION COMPACTION RESULTS
BRANDYWINE ARTERIAL (ROUTE 7)
BINGHAMTON, N.Y.

APPROVED
DISTRICT No. 9
COUNTY BROOME
DRAWING No. 9-1873

FIG. B-11


No. of Passes
0
5
10
15
20
25
30
35
40
45
50
55
60
0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
Settlement (Ft.)
Average Settlement
Sta. 64+25, T.S. No. 6
Average Settlement
Sta. 65+00, T.S. No. 6
Maximum Settlement
Sta. 64+25, T.S. No. 6, 4' L ℄
Maximum Settlement
Sta. 65+00, T.S. No. 6, 2' L ℄
50 Ton Roller
MAXIMUM AND
AVERAGE SETTLEMENT
vs. ROLLER PASSES
TEST STRIP No. 6
STA. 64+25 & 65+00
DEPARTMENT OF PUBLIC WORKS
FOUNDATION COMPACTION RESULTS
BRANDYWINE ARTERIAL (ROUTE 7)
BINGHAMTON, N.Y.
APPROVED
19
DISTRICT No. 9
COUNTY BROOME
DRAWING No. 9-873

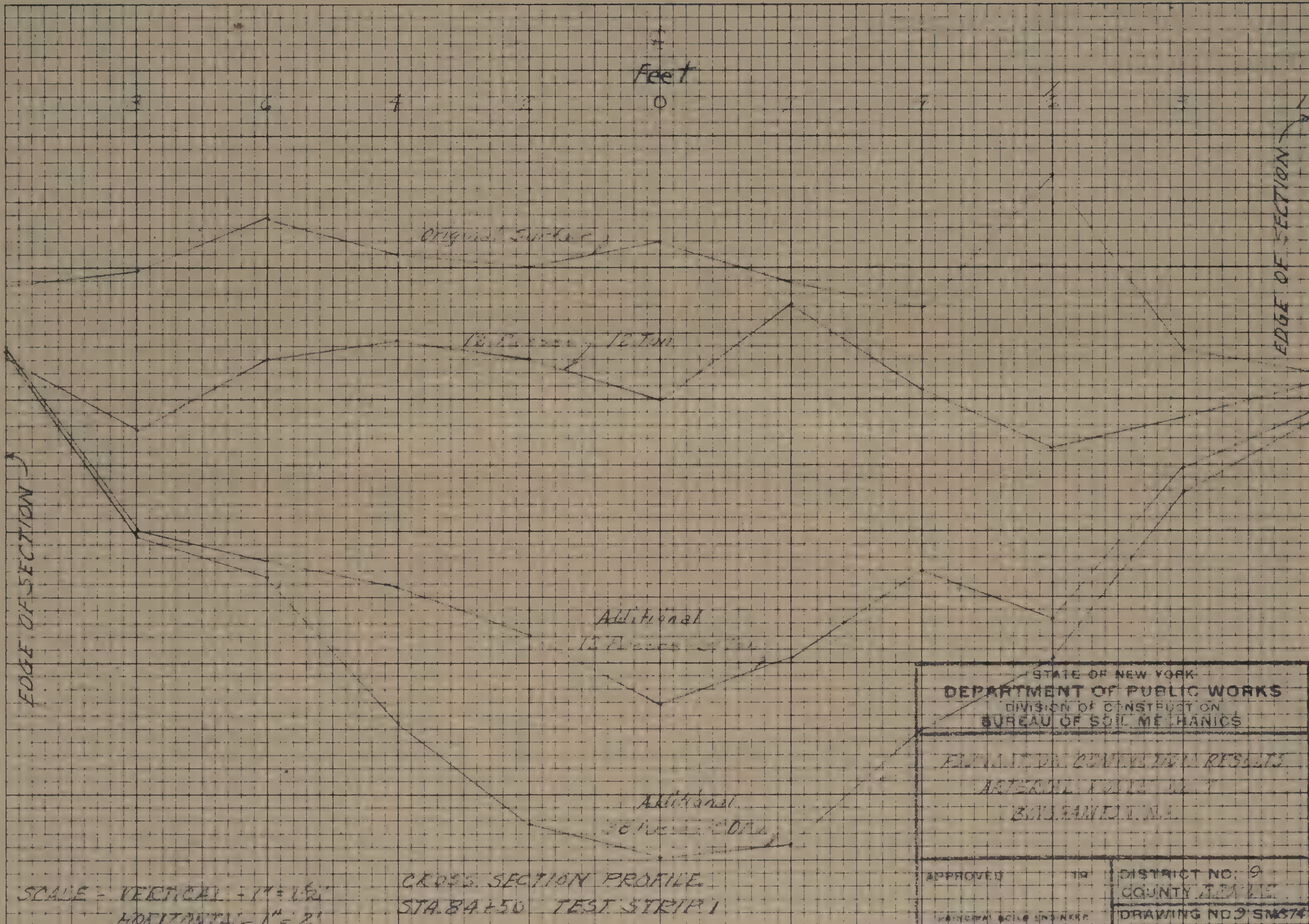

Feet
8
6
4
2
0
2
4
6
8
10
EDGE OF SECTION
EDGE OF SECTION
Original Surface
Additional
Additional
STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
DIVISION OF CONSTRUCTION
BUREAU OF SOIL MECHANICS
APPROVED
DISTRICT NO. 9
COUNTY
DRAWING NO. 9 SM574
CROSS SECTION PROFILE
STA. 84+50 TEST STRIP 1
SCALE = VERTICAL - 1" = 1½'
HORIZONTAL - 1" = 2'

Fig. E-12

NO. 340-10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH

EUGENE DIETZGEN CO.
MADE IN U. S. A.

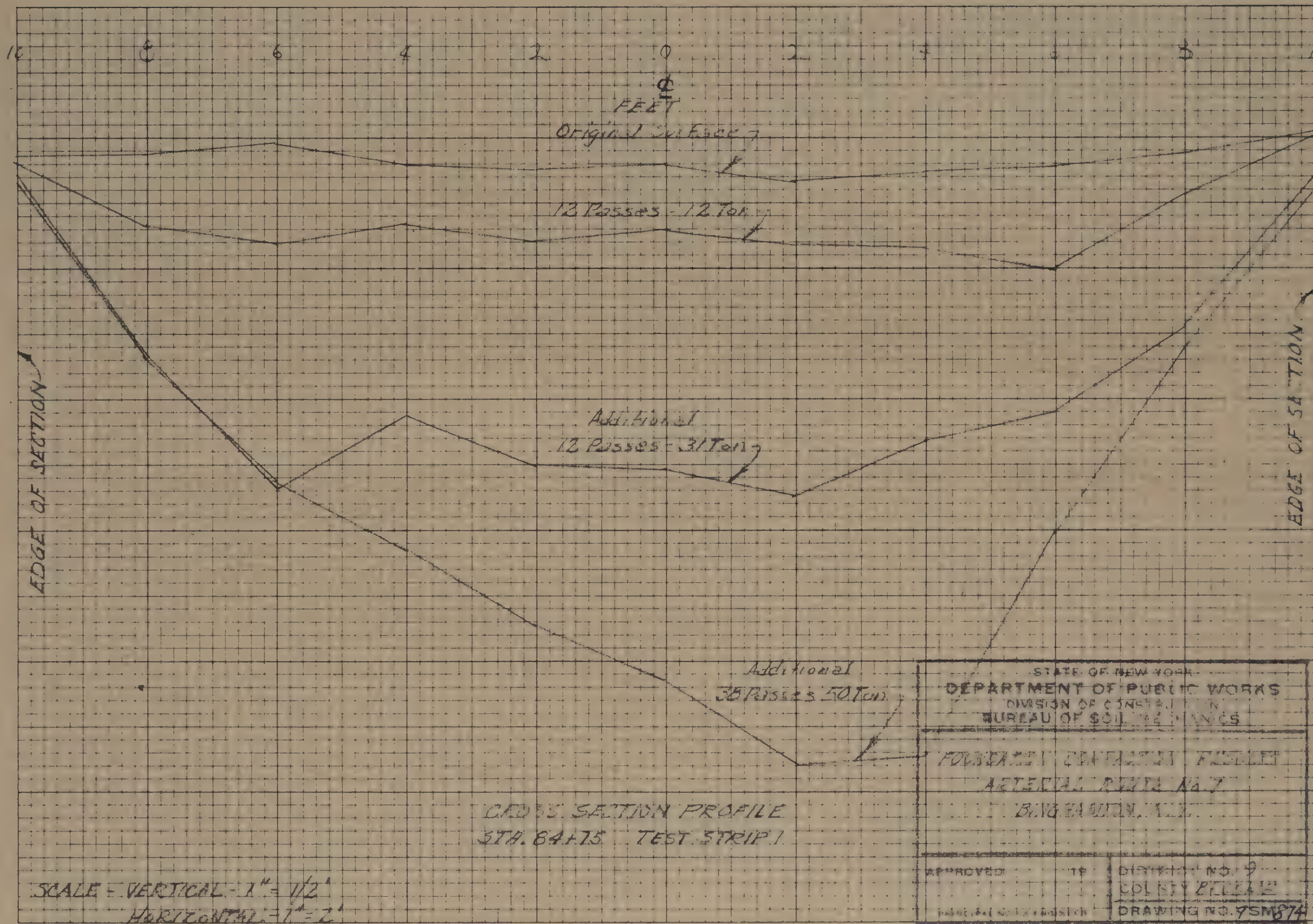


FIG. B-17

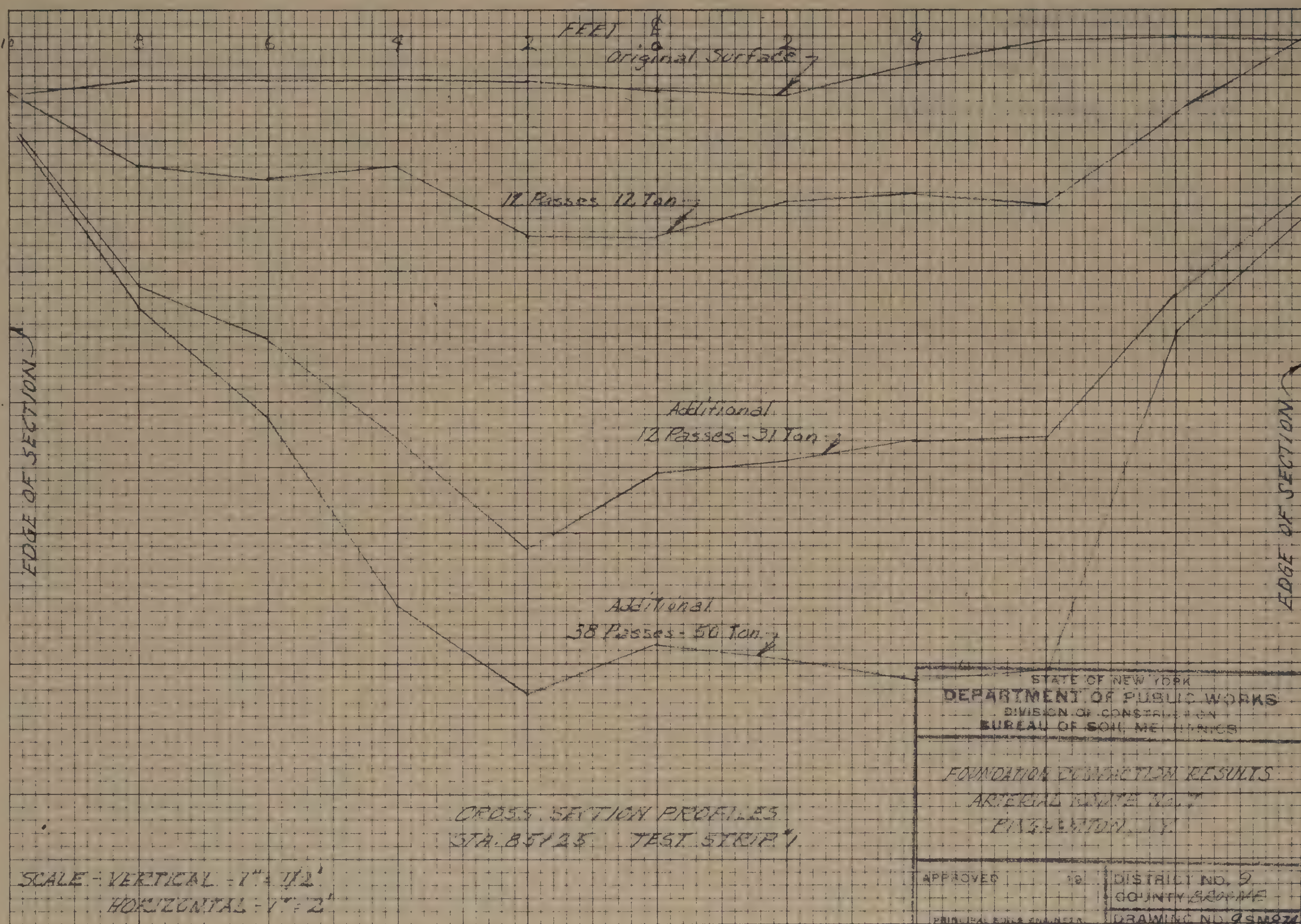

FEET
℄
10
8
6
4
2
0
2
4
8
10
Original Surface
12 Passes 12 Ton
Additional
12 Passes - 31 Ton
Additional
38 Passes - 50 Ton
EDGE OF SECTION
EDGE OF SECTION
CROSS SECTION PROFILES
STA. 85+25 TEST STRIP #1
SCALE - VERTICAL - 1" = 1/2'
HORIZONTAL - 1" = 2'
STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
DIVISION OF CONSTRUCTION
BUREAU OF SOIL MECHANICS
FOUNDATION COMPACTION RESULTS
APPROVED
19
DISTRICT NO. 9
DRAWING NO. 9SM874
PRINCIPAL SOILS ENGINEER

FIG. B-14

NO. 340-10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH

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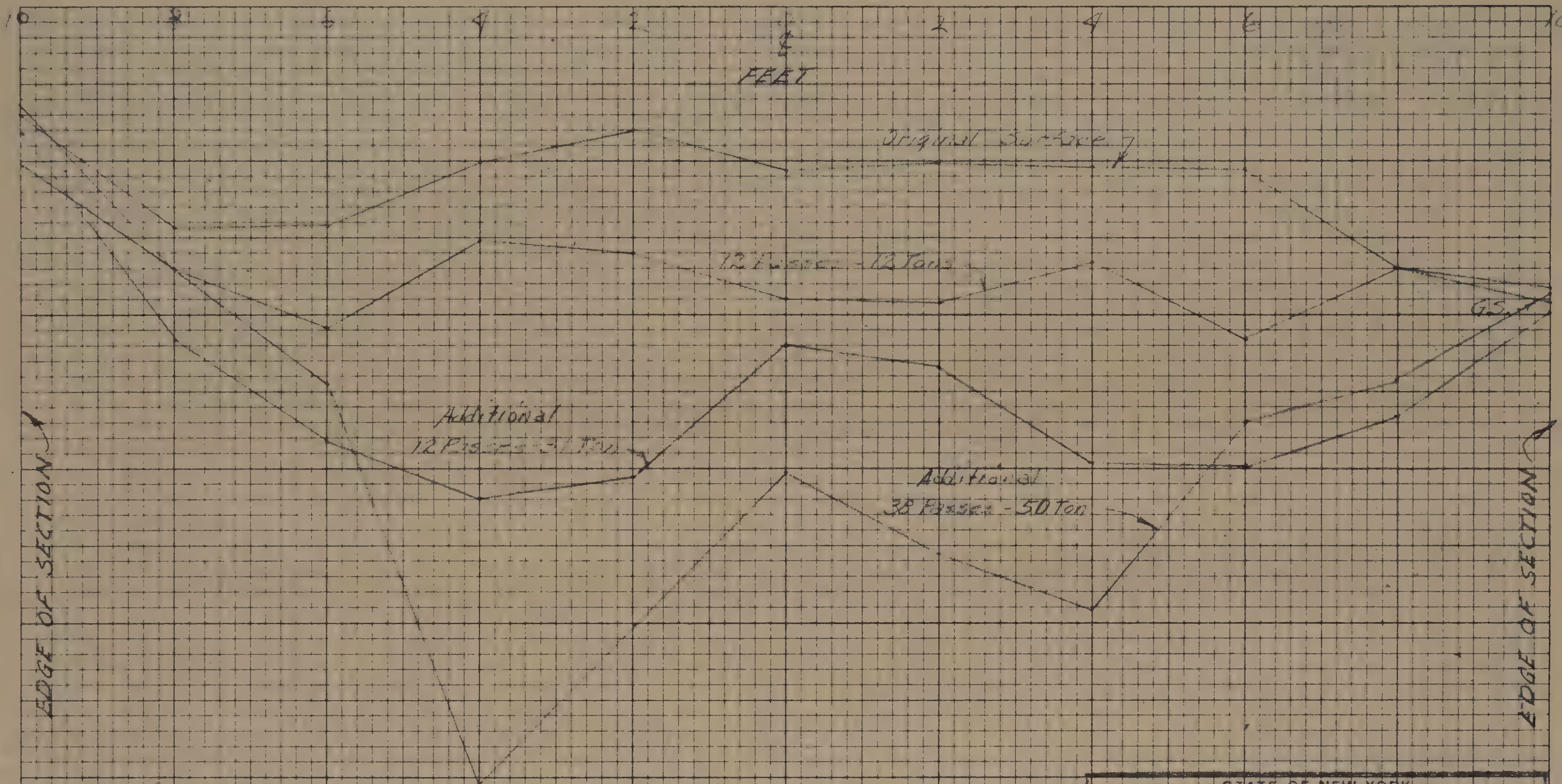
FIG. B-15



CROSS SECTION PROFILES
STA. 85+75 TEST STRIP #1

SCALE - VERTICAL - 1" = 1/2'
HORIZONTAL - 1" = 2'

STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
DIVISION OF CONSTRUCTION
BUREAU OF SOIL MECHANICS

FOUNDATION COMPACTION RESULTS
ARTERIAL ROUTE No. 7
BINGHAMTON, N.Y.

APPROVED 19	DISTRICT NO. 9
PRINCIPAL SOILS ENGINEER	COUNTY BROOME
	DRAWING NO. 9 SM874

NO. 340-10 DIETZGEN GRAPH PAPER
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CROSS SECTION PROFILES
STA. 86+25 TEST STRIP #1

SCALE - VERTICAL - 1" = 1/2'
HORIZONTAL - 1" = 2'

STATE OF NEW YORK
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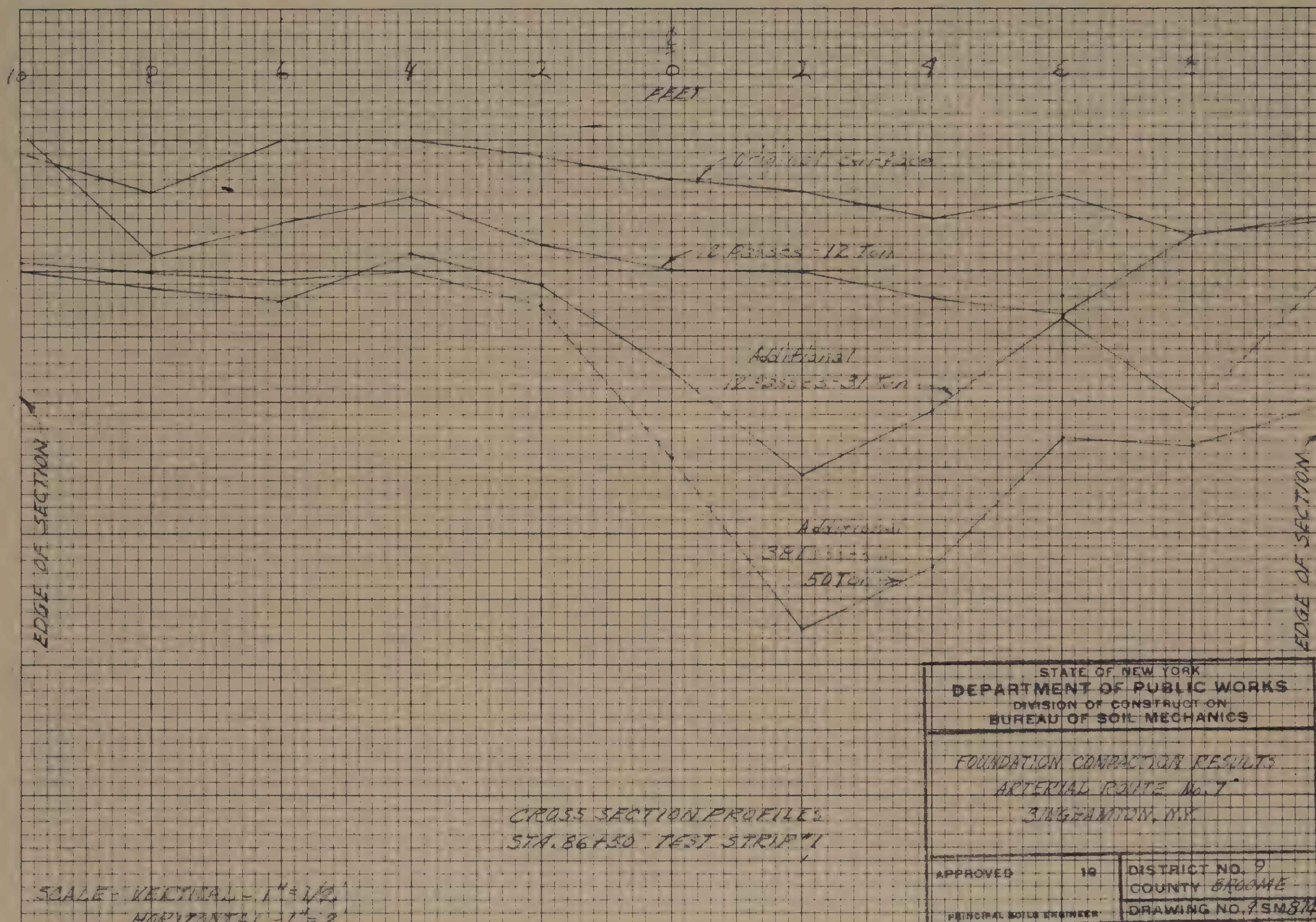
DIVISION OF CONSTRUCTION
BUREAU OF SOIL MECHANICS

FOUNDATION COMPACTION RESULTS
ARTERIAL ROUTE No. 7
BINGHAMTON, N.Y.

APPROVED 19	DISTRICT NO. 9
	COUNTY BROOME
PRINCIPAL SOILS ENGINEER	DRAWING NO. 9SM874

FIG B-16

FIG. 8-11



STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
DIVISION OF CONSTRUCTION
BUREAU OF SOIL MECHANICS

FOUNDATION COMPACTION RESULTS
ARTERIAL ROUTE No. 7
BINGHAMTON, N.Y.

APPROVED ______ 19__
PRINCIPAL SOILS ENGINEER

DISTRICT NO. 9
COUNTY BROOME
DRAWING NO. 9 SM 874

NO. 340-10 DIETZGEN GRAPH PAPER
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EUGENE DIETZGEN CO.
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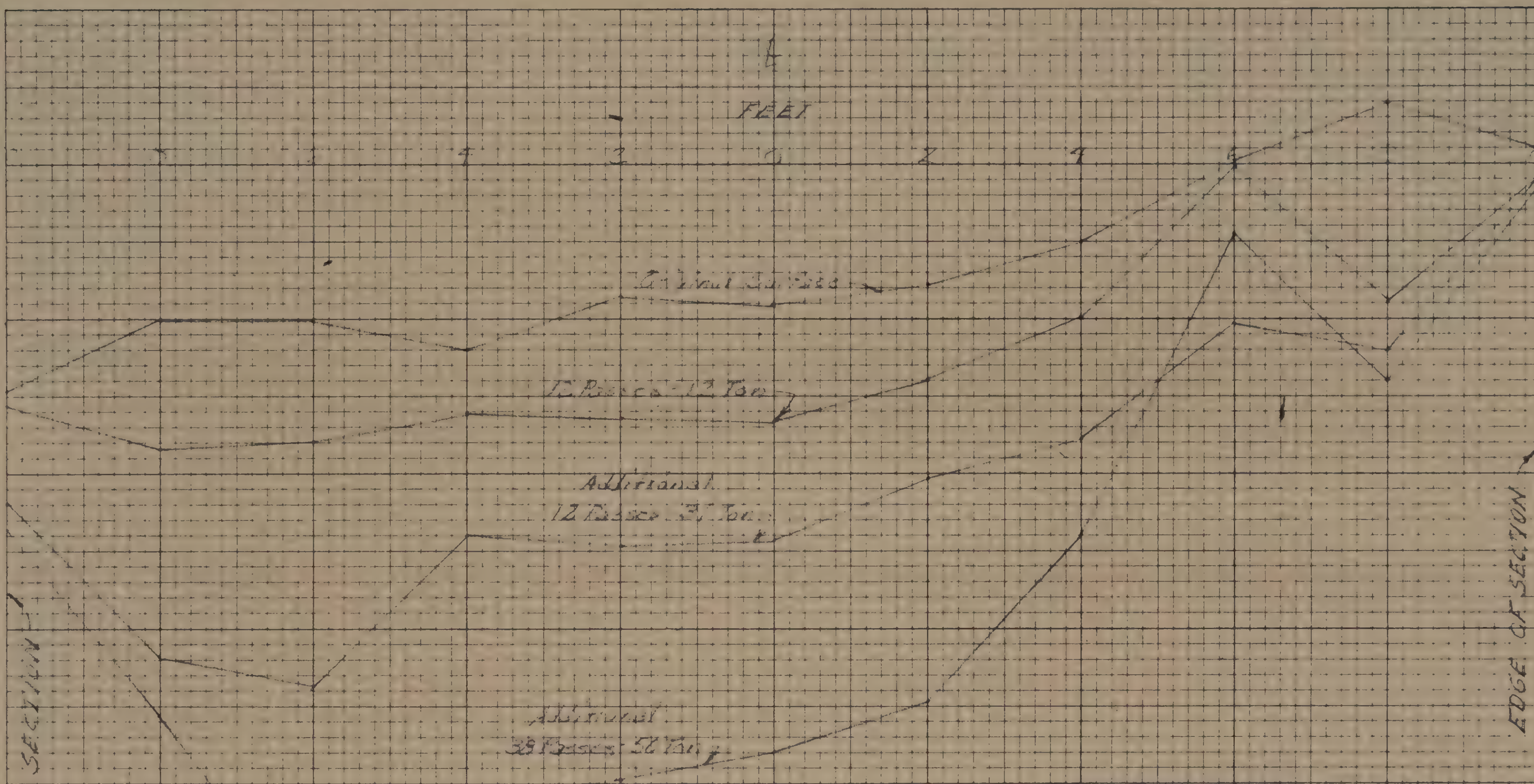

CROSS SECTION PROFILES
STA. 80+50 TEST STRIP #2

SCALE - VERTICAL 1" = 1'
HORIZONTAL - 1" = 2'

STATE OF NEW YORK
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DIVISION OF CONSTRUCTION
BUREAU OF SOIL MECHANICS

FOUNDATION COMPACTION RESULTS
ARTERIAL ROUTE
BINGHAMTON, N.Y.

APPROVED 19
PRINCIPAL SOILS ENGINEER

DISTRICT NO. 9
COUNTY
DRAWING NO.

NO. 340-10 DIETZGEN GRAPH PAPER
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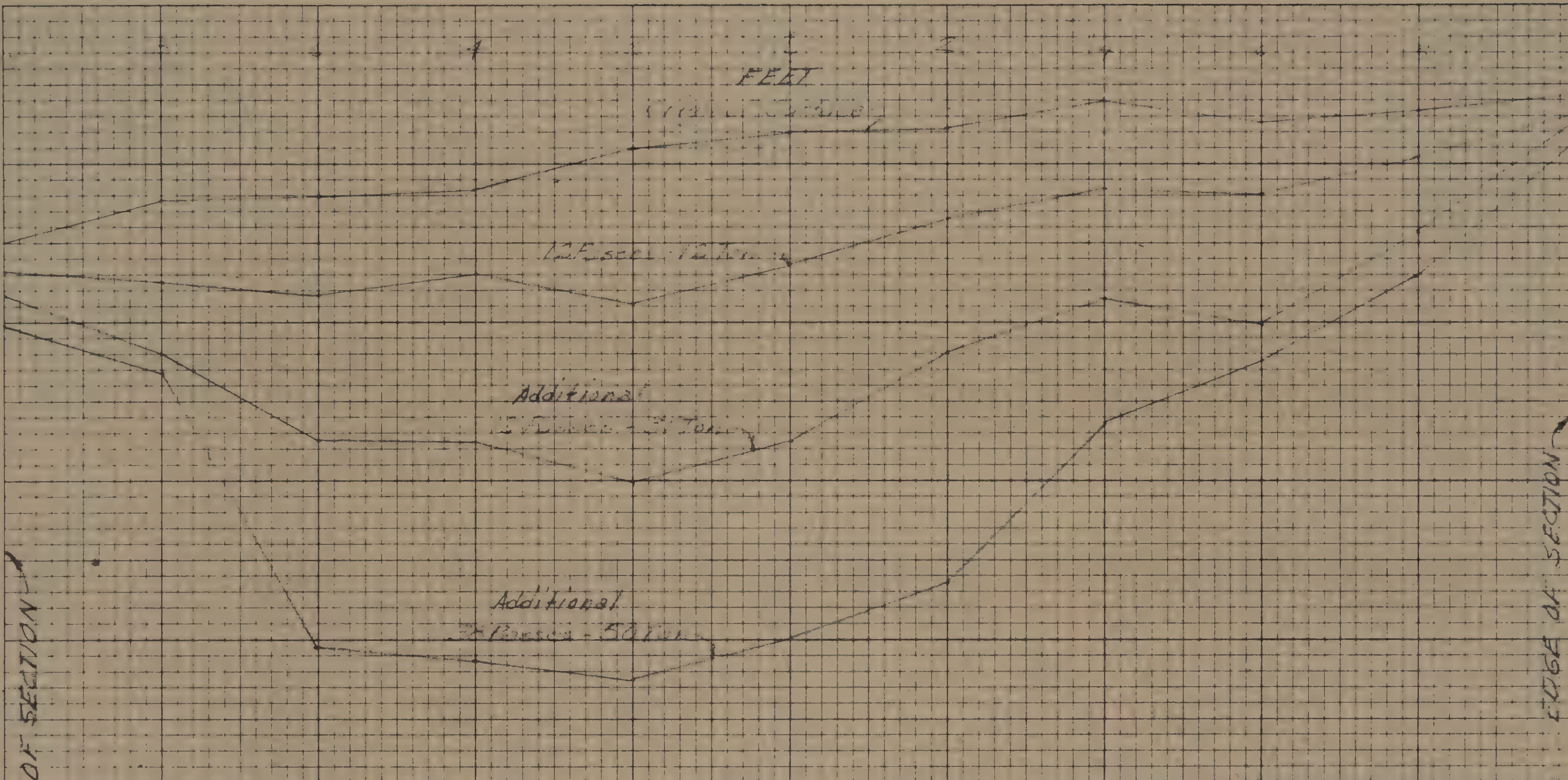


CROSS SECTION PROFILES
STA. 8Ø+75 TEST STRIP #2

SCALE – VERTICAL – 1" = 1/2'
HORIZONTAL – 1" = 2'

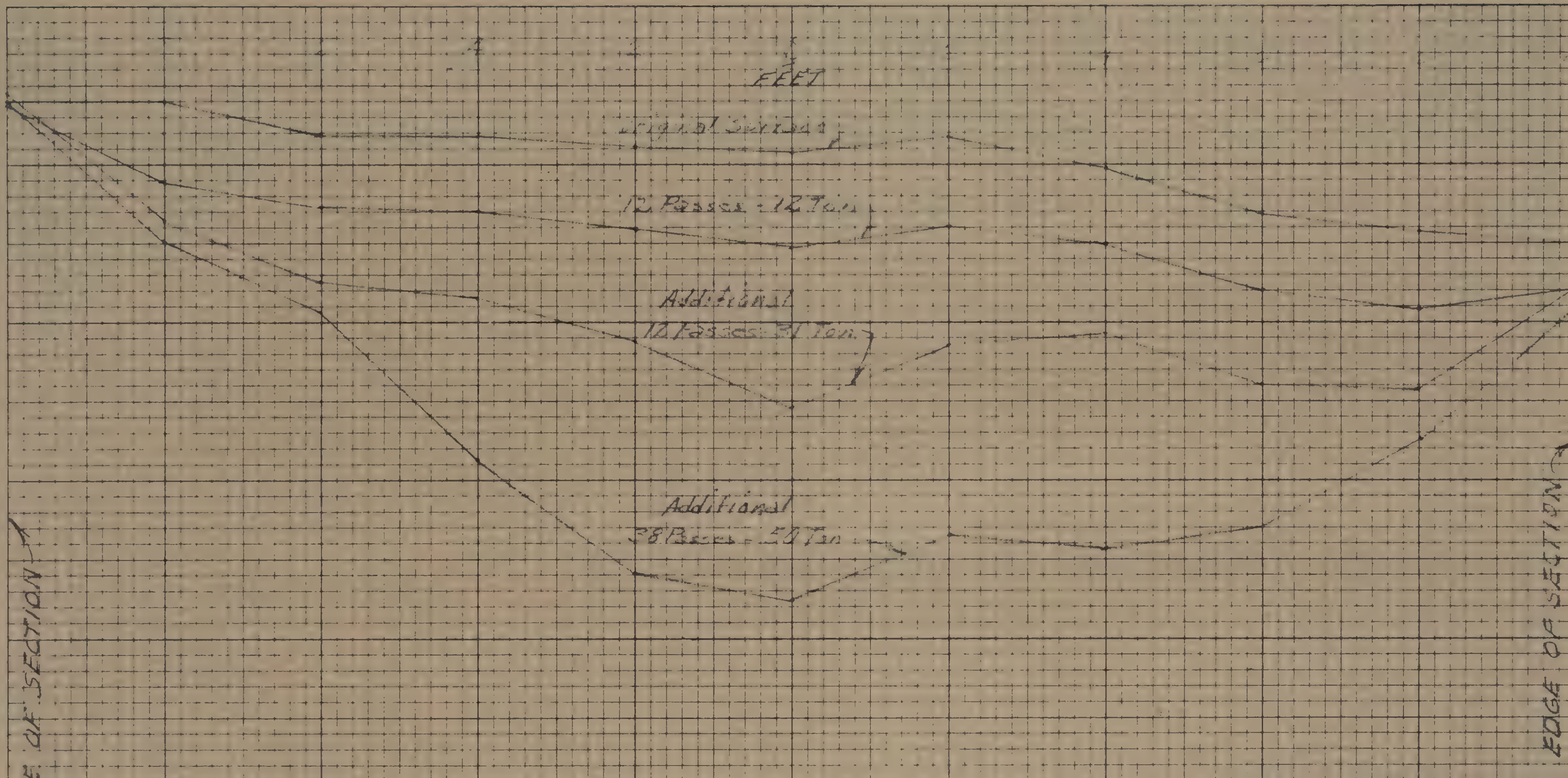
STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
DIVISION OF CONSTRUCTION
BUREAU OF SOIL MECHANICS

FOUNDATION COMPACTION RESULTS
ARTERIAL ROUTE No. 7
BINGHAMTON, N.Y.

APPROVED 19	DISTRICT NO. 9
	COUNTY BROOME
PRINCIPAL SOILS ENGINEER	DRAWING NO. 9SM874

FIG B-19

FIG. H-20



CROSS SECTION PROFILES
STA. 81+25 TEST STRIP #2

SCALE: VERTICAL - 1" = 1/2'
HORIZONTAL - 1" = 2'

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BUREAU OF SOIL MECHANICS

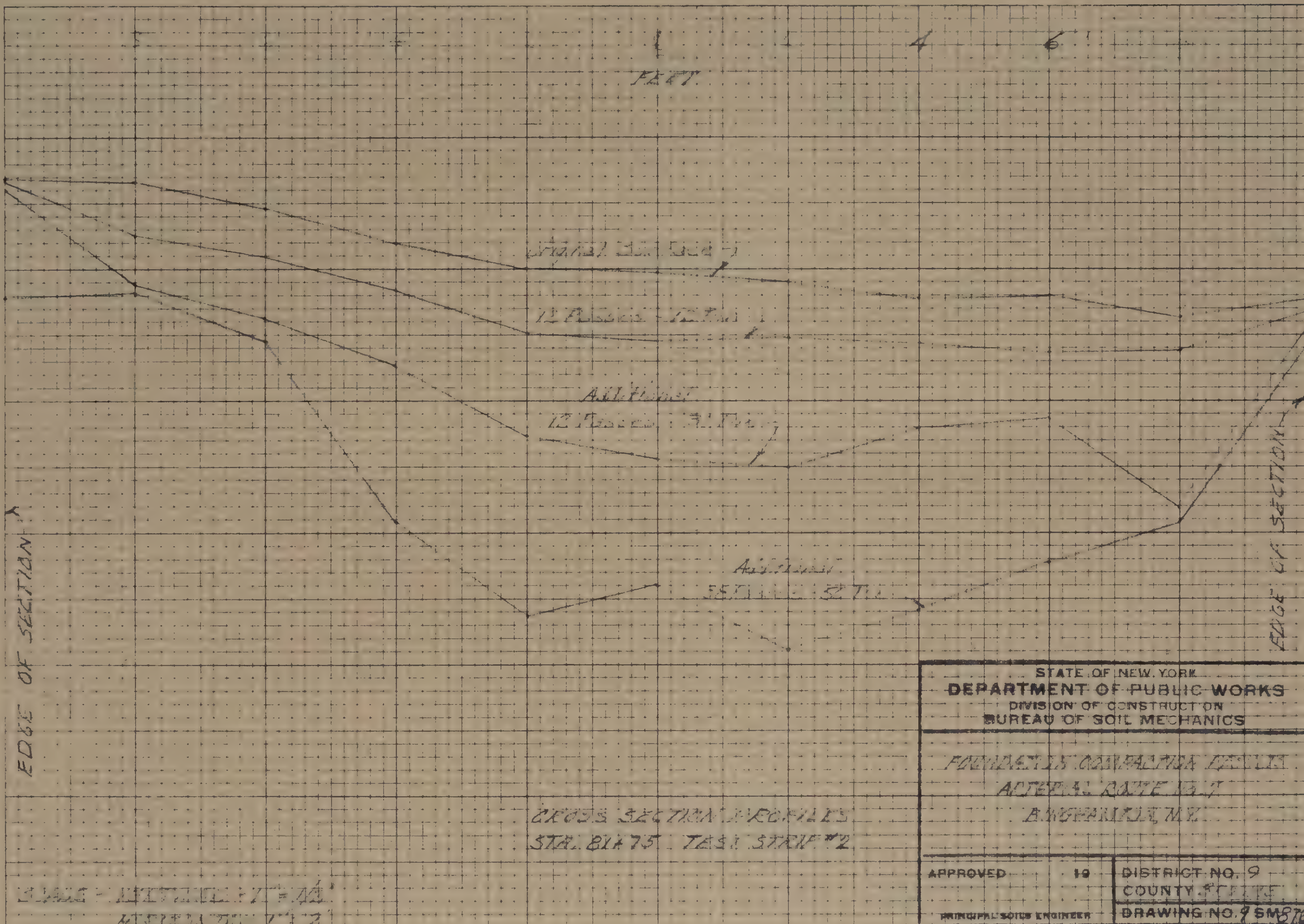
FOUNDATION COMPACTION RESULTS
ARTERIAL ROUTE No. 7
BINGHAMTON, N.Y.

APPROVED 19
PRINCIPAL SOILS ENGINEER

DISTRICT NO. 9
COUNTY Broome
DRAWING NO. 9 SM 876

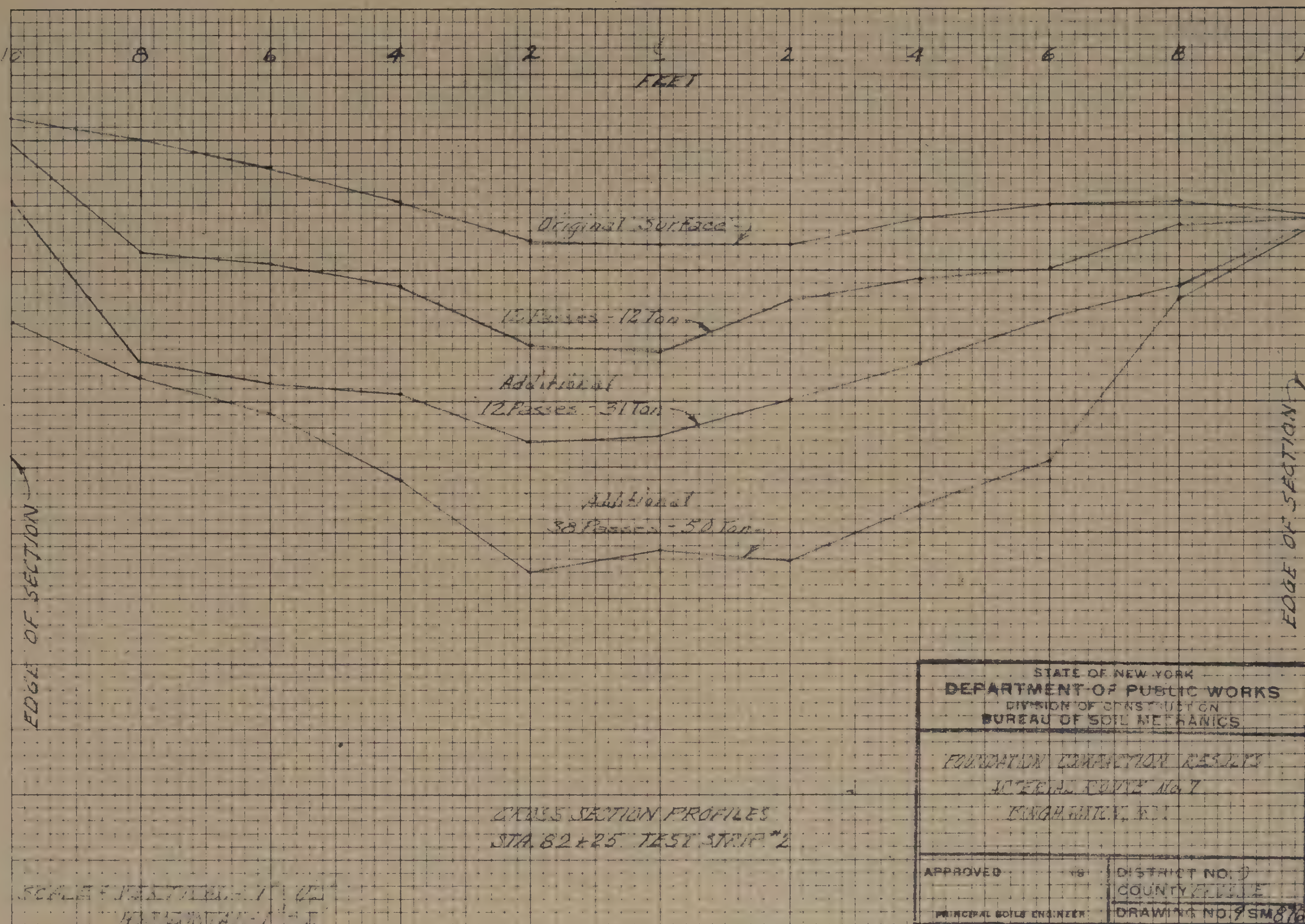
NO. 340-10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH

EUGENE DIETZGEN CO.
MADE IN U. S. A.



NO. 340-10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH

EUGENE DIETZGEN CO.
MADE IN U. S. A.



NO. 340-10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH

EUGENE DIETZGEN CO.
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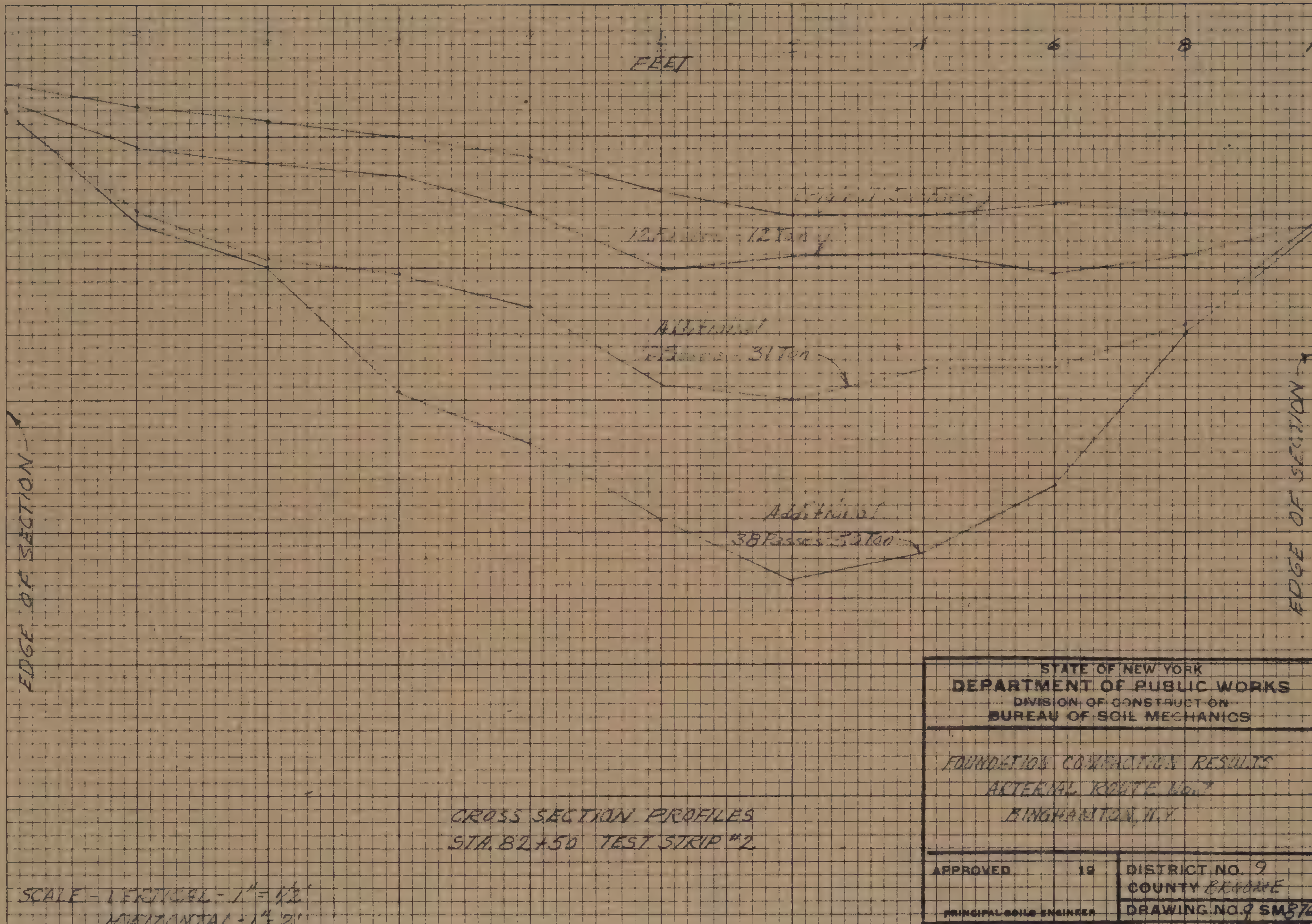
FIG. B-23



NO. 340-10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH

EUGENE DIETZGEN CO.
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FIG. E-24

NO. 340-10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH

EUGENE DIETZGEN CO.
MADE IN U. S. A.

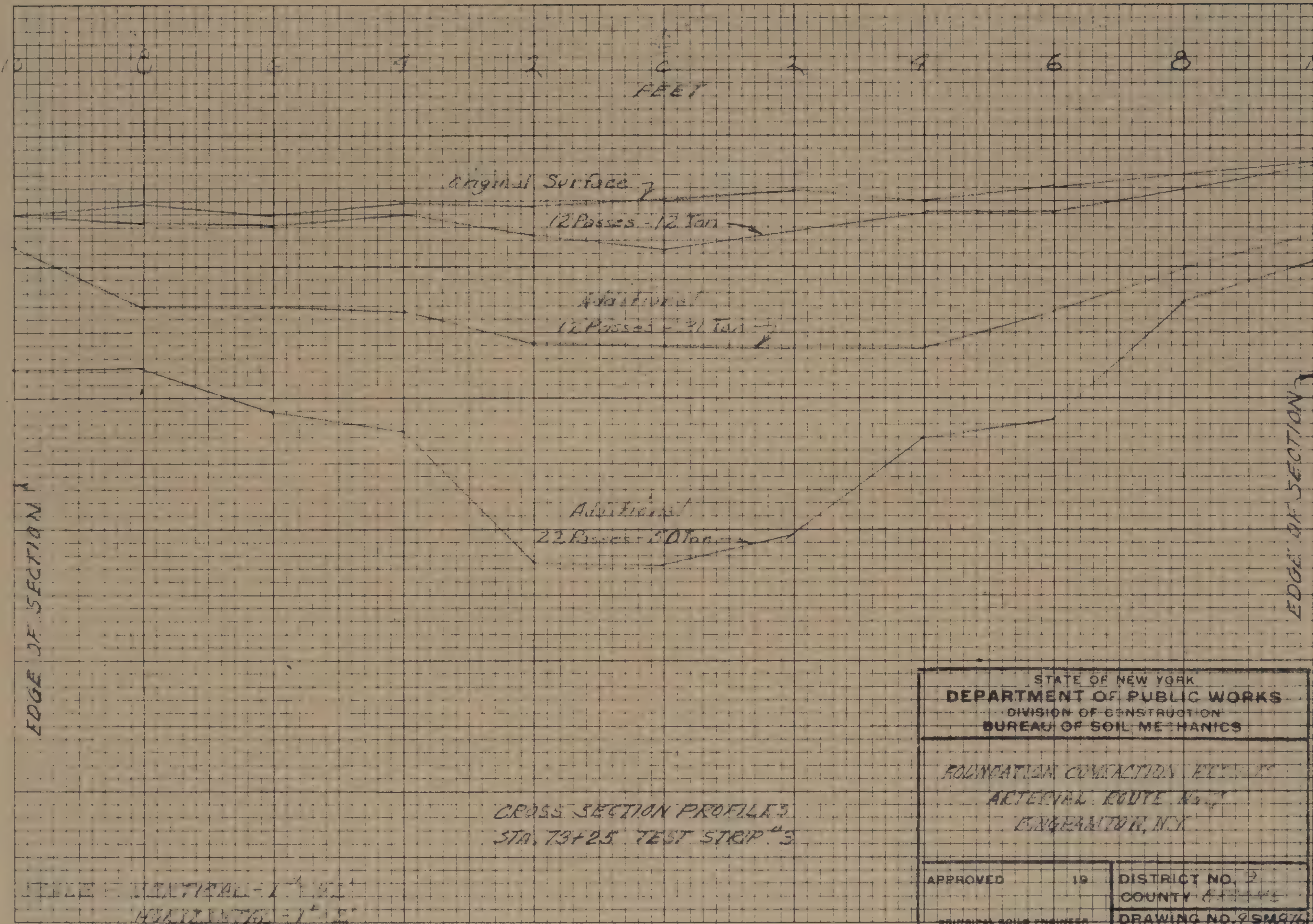
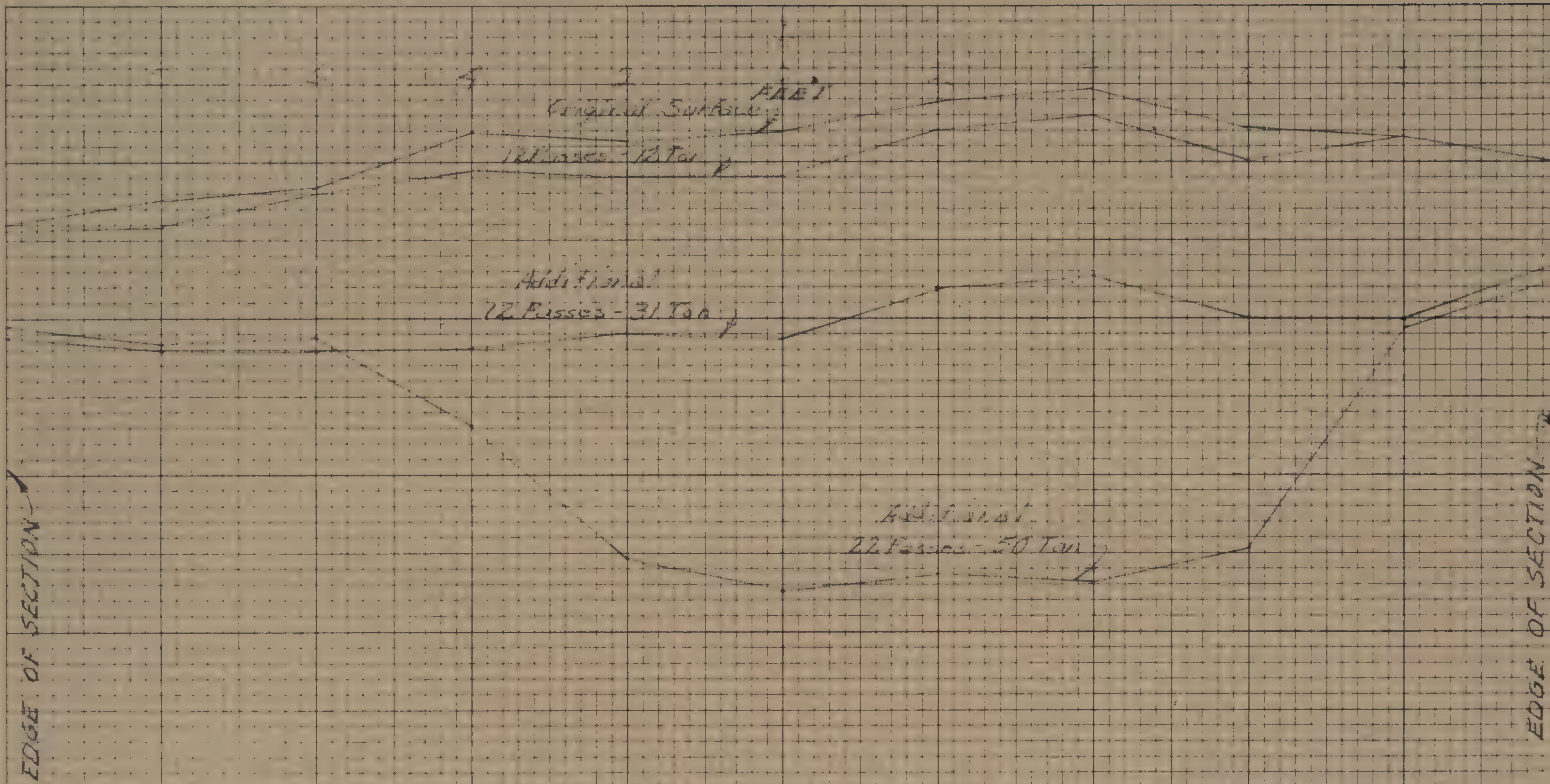


FIG. B-25

NO. 340-10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH

EUGENE DIETZGEN CO.
MADE IN U. S. A.



CROSS SECTION PROFILES
STA. 73+75 TEST STRIP #3

STATE OF NEW YORK
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DIVISION OF CONSTRUCTION
BUREAU OF SOIL MECHANICS

FOUNDATION COMPACTION RESULTS
ARTERIAL ROUTE NO. 7
BINGHAMTON, N.Y.

APPROVED 19	DISTRICT NO. 9
	COUNTY Broome
PRINCIPAL SOILS ENGINEER	DRAWING NO. 9SM876

Fig. B

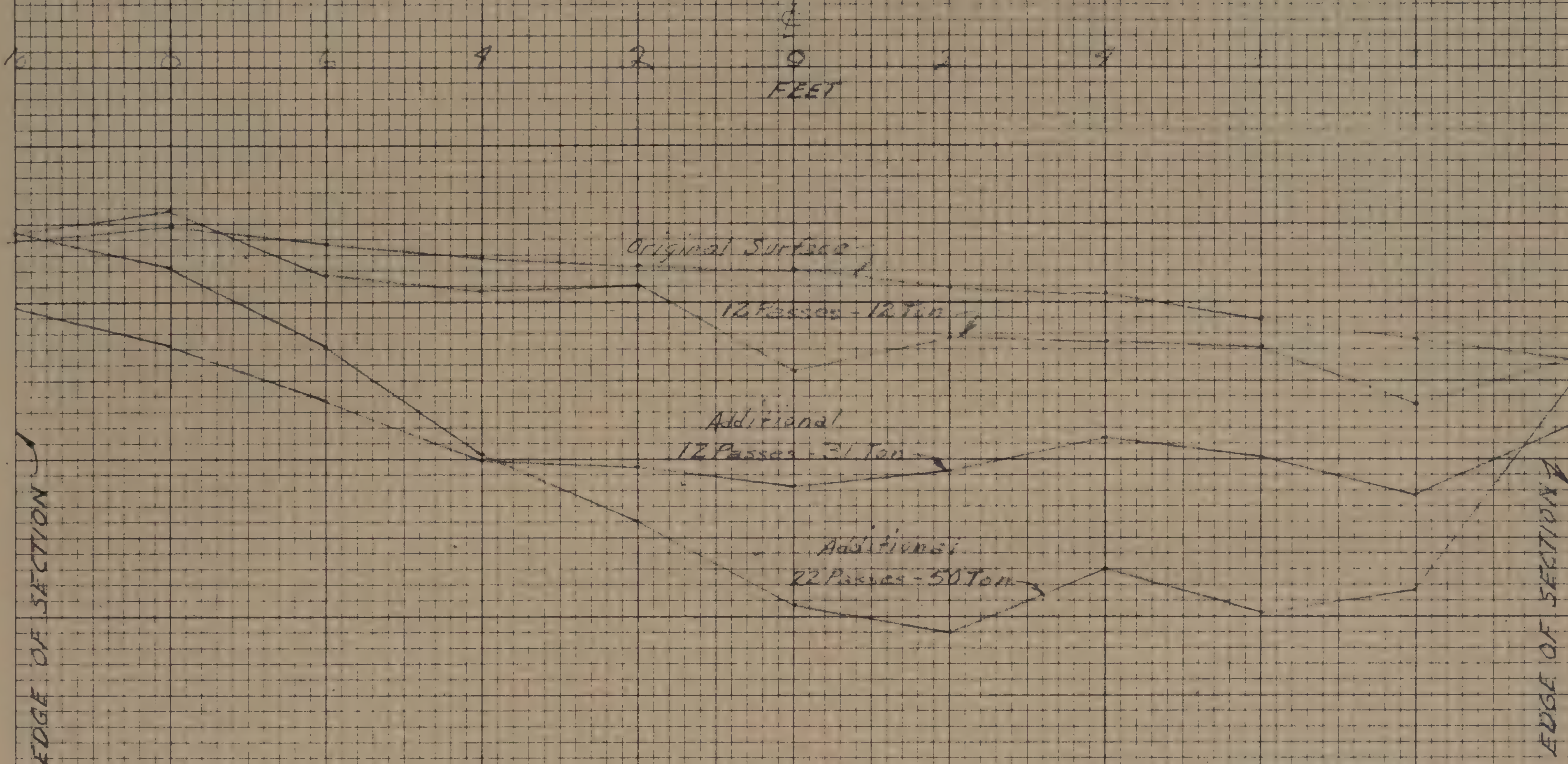
FIG. F-21


FEET
0
2
4
2
EDGE OF SECTION
EDGE OF SECTION
Original Surface
12 Passes 12 Ton
12 Passes 37 Ton (Add. Final)
Add. Final
22 Passes 50 Ton
CROSS SECTION PROFILES
STA. 74+25 TEST STRIP #3
STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
DIVISION OF CONSTRUCTION
BUREAU OF SOIL MECHANICS
COMPACTION RESULTS
BINGHAMTON, N.Y.
APPROVED 19
PRINCIPAL SOILS ENGINEER
DISTRICT NO. 9
COUNTY BROOME
DRAWING NO. 9SM876

NO. 340-10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH

EUGENE DIETZGEN CO.
MADE IN U. S. A.

FIG. 6-3



CROSS SECTION PROFILES
STA. 74+75 TEST STRIP #3

STATE OF NEW YORK
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DIVISION OF CONSTRUCTION
BUREAU OF SOIL MECHANICS

ARTERIAL ROUTE

APPROVED 19
PRINCIPAL SOILS ENGINEER

DISTRICT NO. 9
COUNTY
DRAWING NO. SM876

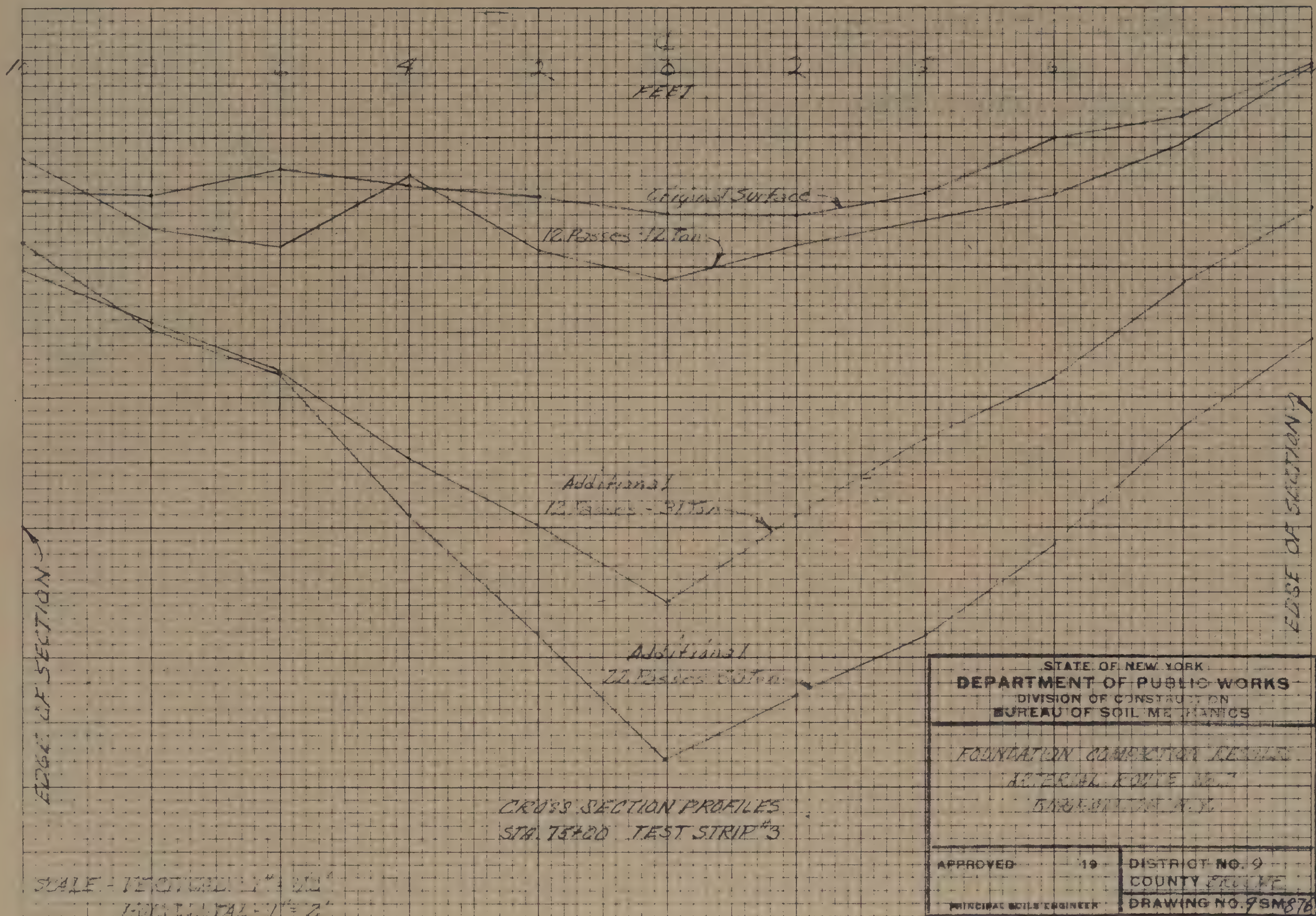
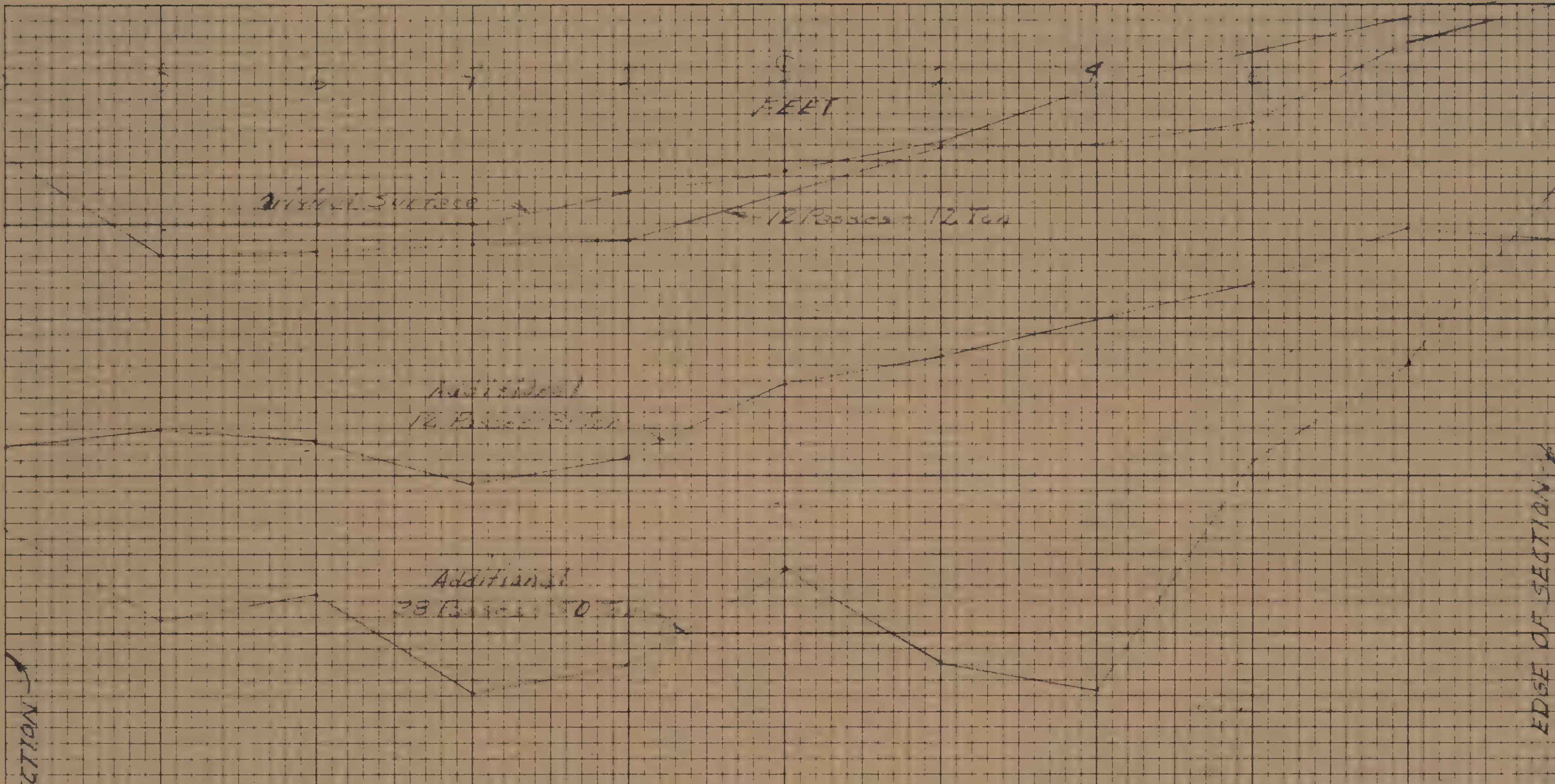

FEET
4
2
0
2
Original Surface
12 Passes 12 Ton
Additional
Additional
EDGE OF SECTION
EDGE OF SECTION
CROSS SECTION PROFILES
STA. 75+00 TEST STRIP #3
STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
DIVISION OF CONSTRUCTION
BUREAU OF SOIL MECHANICS
APPROVED 19
PRINCIPAL SOILS ENGINEER
DISTRICT NO. 9
COUNTY
DRAWING NO. 9SM876

FIG. B-30

NO. 340-10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH

EUGENE DIETZGEN CO.
MADE IN U. S. A.



STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
DIVISION OF CONSTRUCTION
BUREAU OF SOIL MECHANICS

FOUNDATION COMPACTION RESULTS
ARTERIAL ROUTE No. 7
BINGHAMTON, N.Y.

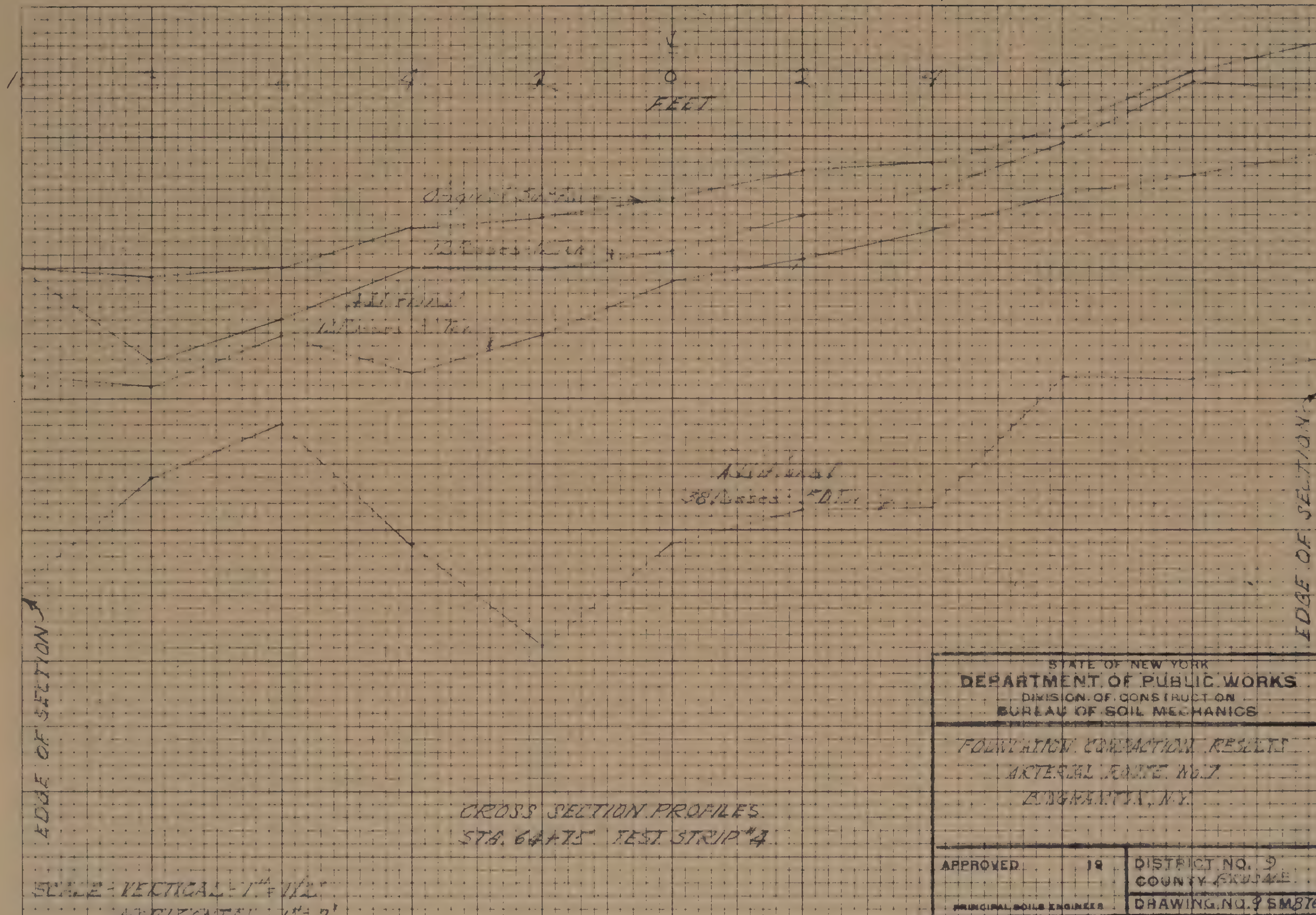
CROSS SECTION PROFILES
STA. 65+00 TEST STRIP #4

SCALE - VERTICAL - 1" = 1/2'
HORIZONTAL - 1" = 2'

APPROVED 19	DISTRICT NO. 9
	COUNTY [illegible]
PRINCIPAL SOILS ENGINEER	DRAWING NO. 9 SM 876

NO. 340-10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH

EUGENE DIETZGEN CO.
MADE IN U. S. A.



STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
DIVISION OF CONSTRUCTION
BUREAU OF SOIL MECHANICS

FOUNDATION COMPACTION RESULTS
ARTERIAL ROUTE NO. 7
[illegible], N.Y.

APPROVED 19
PRINCIPAL SOILS ENGINEER

DISTRICT NO. 9
COUNTY [illegible]
DRAWING NO. 9 SM 876

Fig. B-31

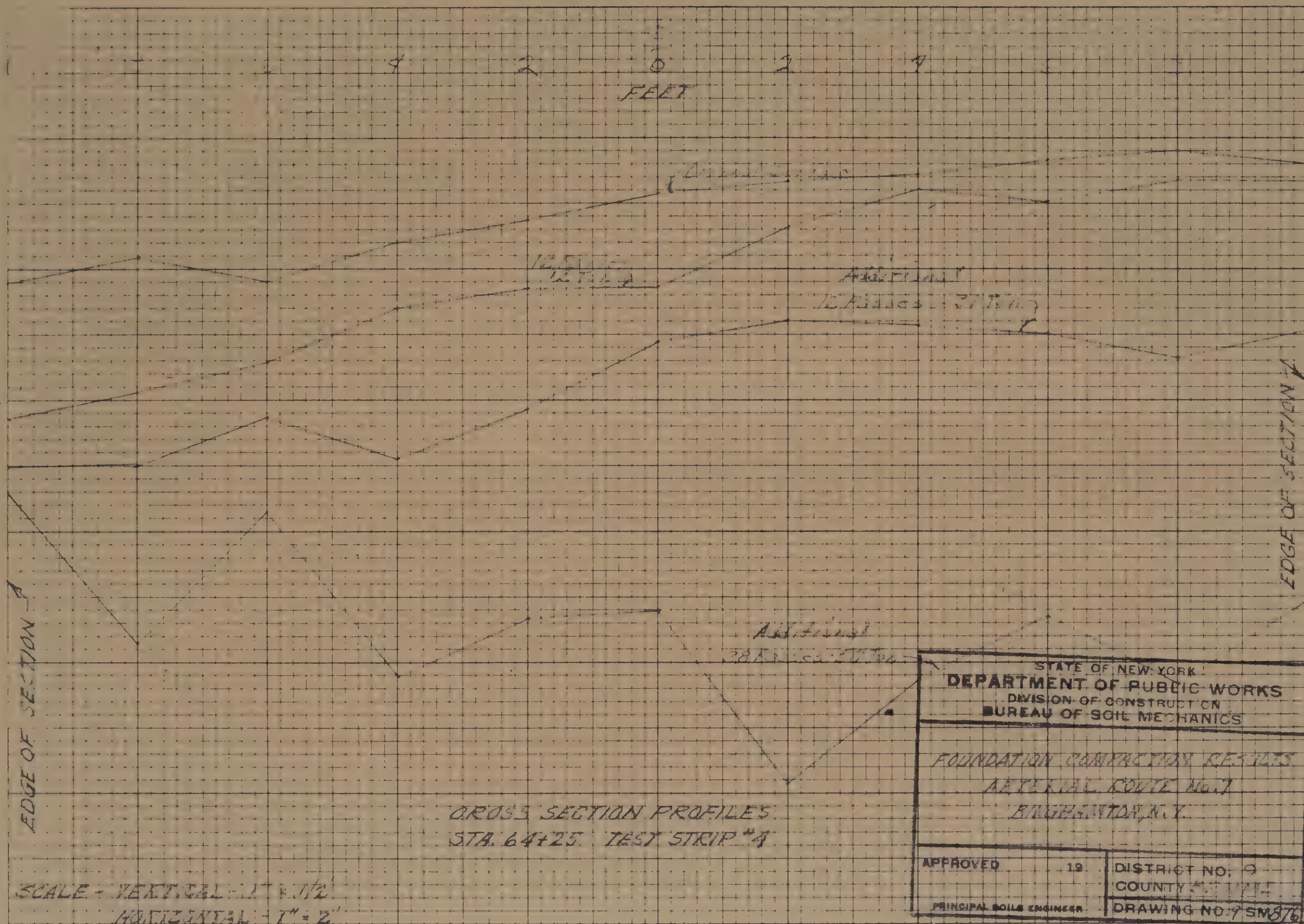

4 2 0 2 4
FEET
EDGE OF SECTION
EDGE OF SECTION
CROSS SECTION PROFILES
STA. 64+25 TEST STRIP #4
HORIZONTAL - 1" = 2'
STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
DIVISION OF CONSTRUCTION
BUREAU OF SOIL MECHANICS
FOUNDATION COMPACTION RESULTS
ARTERIAL ROUTE No. 7
APPROVED 19
PRINCIPAL SOILS ENGINEER
DISTRICT NO. 9
COUNTY
DRAWING NO. 7 SM 876

FIG. B-32

FIG. B-33


10 8 6 4 2 0 2 4 6 8 10
FEET
Original Surface
12 Passes 12 Ton
Additional
12 Passes 37 Ton
Additional
38 Passes 50 Tons
EDGE OF SECTION
EDGE OF SECTION
CROSS SECTION PROFILES
STA. 63+75 TEST STRIP #4
SCALE - VERTICAL - 1" = 1/2'
HORIZONTAL - 1" = 2'
STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
DIVISION OF CONSTRUCTION
BUREAU OF SOIL MECHANICS
FOUNDATION COMPACTION RESULTS
ARTERIAL ROUTE
BINGHAMTON, N.Y.
APPROVED 19
PRINCIPAL SOILS ENGINEER
DISTRICT NO. 9
COUNTY
DRAWING NO. 9 SM 876


FEET
Original Surface
12 Passes
12 Ton
Add'l. Fill
12 Passes - 31 Tons
EDGE OF SECTION
EDGE OF SECTION
38 Passes
CROSS SECTION PROFILES
STA. 63+25 TEST STRIP #4
DEPARTMENT OF PUBLIC WORKS
APPROVED
DISTRICT NO. 9
COUNTY

FIG. B-35

NO. 340-10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH

EUGENE DIETZGEN CO.
MADE IN U. S. A.

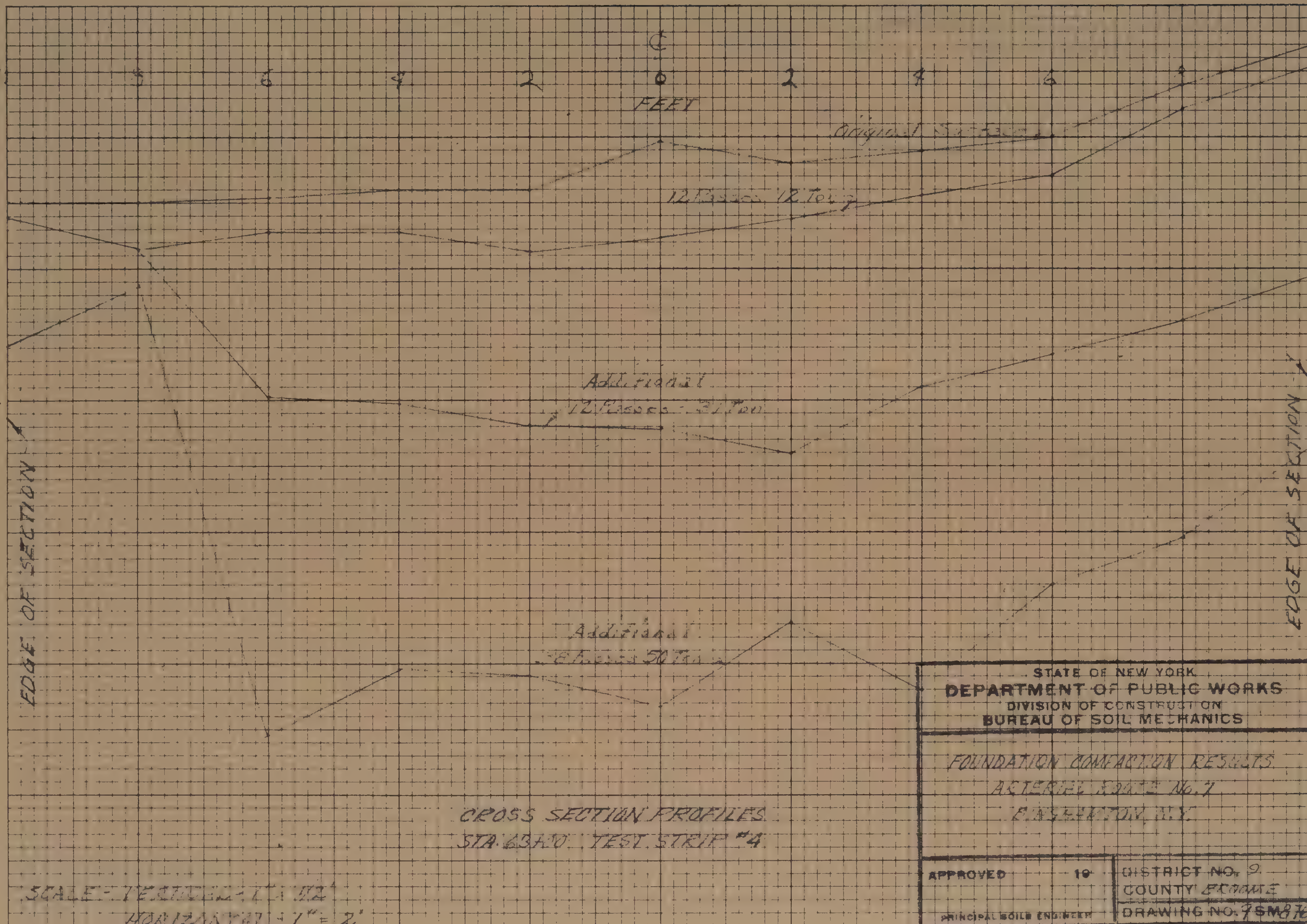


FIG.

CROSS SECTION PROFILES
STA. 61+00 TEST STRIP 5

SCALE- VERTICAL 1" = 1'
HORIZONTAL 1" = 2'

STATE OF NEW YORK
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DIVISION OF CONSTRUCTION
BUREAU OF SOIL MECHANICS

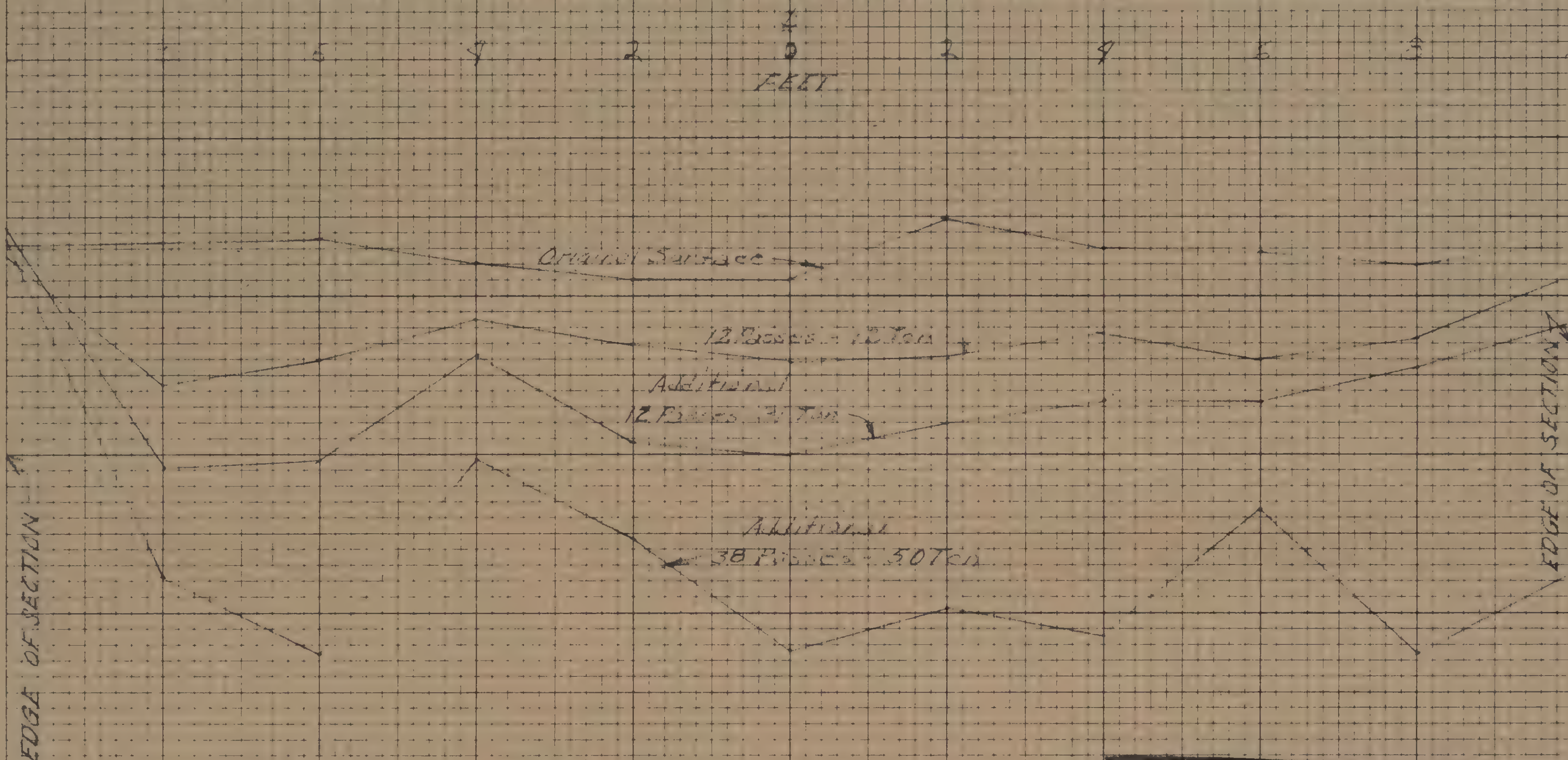
FOUNDATION COMPACTION RESULTS
ARTERIAL ROUTE No. 7
BINGHAMTON, N.Y.

APPROVED 19
PRINCIPAL SOILS ENGINEER

DISTRICT NO. 9
COUNTY BROOME
DRAWING NO. 7SM876

NO. 340-10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH

EUGENE DIETZGEN CO.
MADE IN U. S. A.

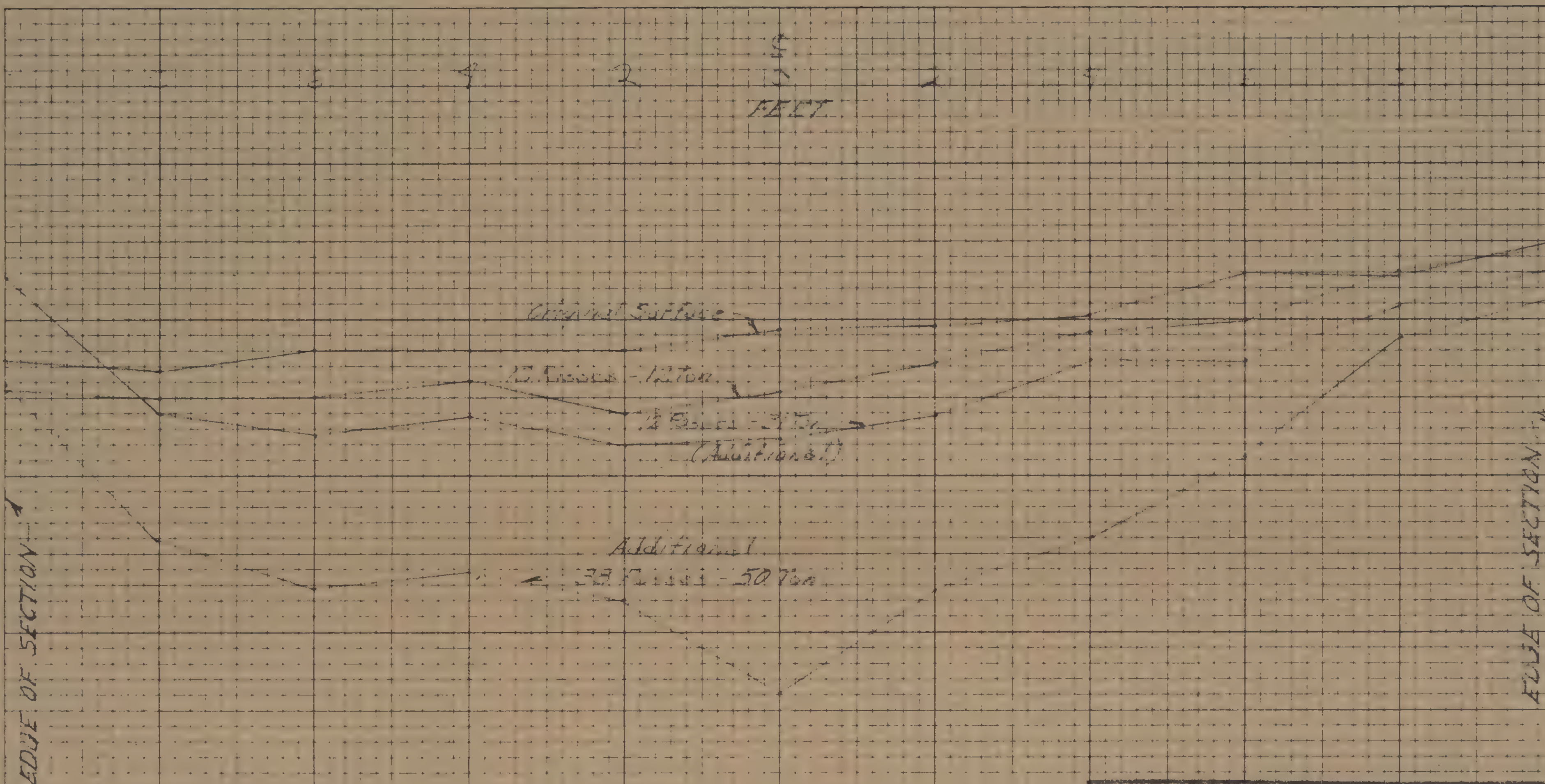


CROSS SECTION PROFILES
STA. 60+75 TEST STRIP #5

SCALE - VERTICAL - 1" = ½'
HORIZONTAL - 1" = 2'

STATE OF NEW YORK DEPARTMENT OF PUBLIC WORKS DIVISION OF CONSTRUCTION BUREAU OF SOIL MECHANICS	
FOUNDATION ... ARTERIAL ROUTE No. 7 BINGHAMTON, N.Y.	
APPROVED 19	DISTRICT NO. 9 COUNTY BROOME
PRINCIPAL SOILS ENGINEER	DRAWING NO. 9SM876

FIG. C-



CROSS SECTION PROFILES
STA. 60+25 TEST STRIP 5

SCALE - VERTICAL - 1" = 1 1/2'
HORIZONTAL - 1" = 2'

STATE OF NEW YORK
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DIVISION OF CONSTRUCTION
BUREAU OF SOIL MECHANICS

APPROVED 19
PRINCIPAL SOILS ENGINEER

DISTRICT NO.
COUNTY
DRAWING NO. SM876

NO. 340-10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH

EUGENE DIETZGEN CO.
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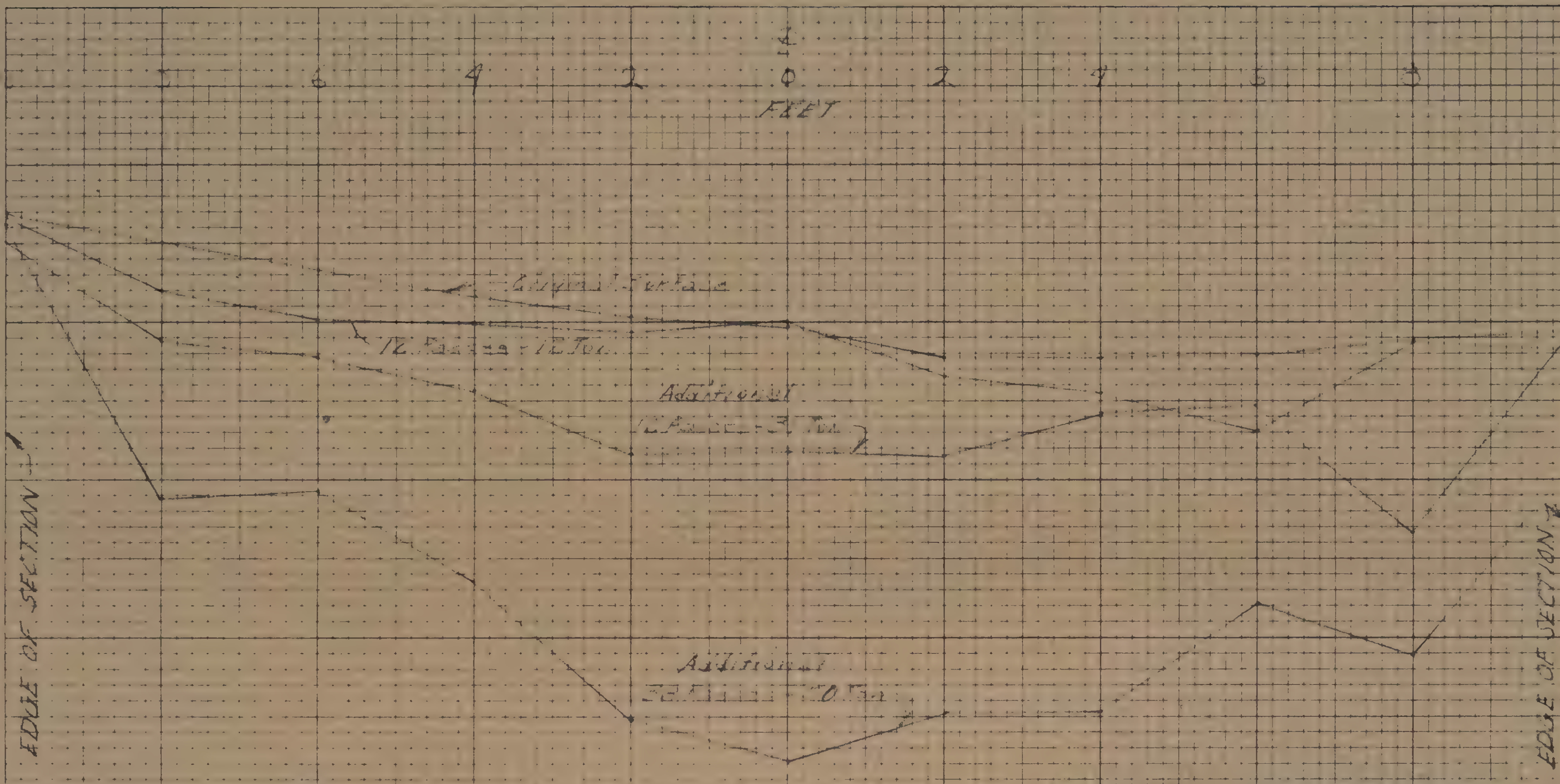

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DEPARTMENT OF PUBLIC WORKS
DIVISION OF CONSTRUCTION
BUREAU OF SOIL MECHANICS

FOUNDATION COMPACTION RESULTS
ARTERIAL ROUTE No. 1
BINGHAMTON, N.Y.

CROSS SECTION PROFILES
STA. 59+75 TEST STRIP #5

SCALE - VERTICAL - 1" = 1/2'
HORIZONTAL - 1" = 2'

APPROVED .... 19..		DISTRICT NO. 9
PRINCIPAL SOILS ENGINEER		COUNTY BROOME
		DRAWING NO. 9SM87

NO. 340-10 DIETZGEN GRAPH PAPER
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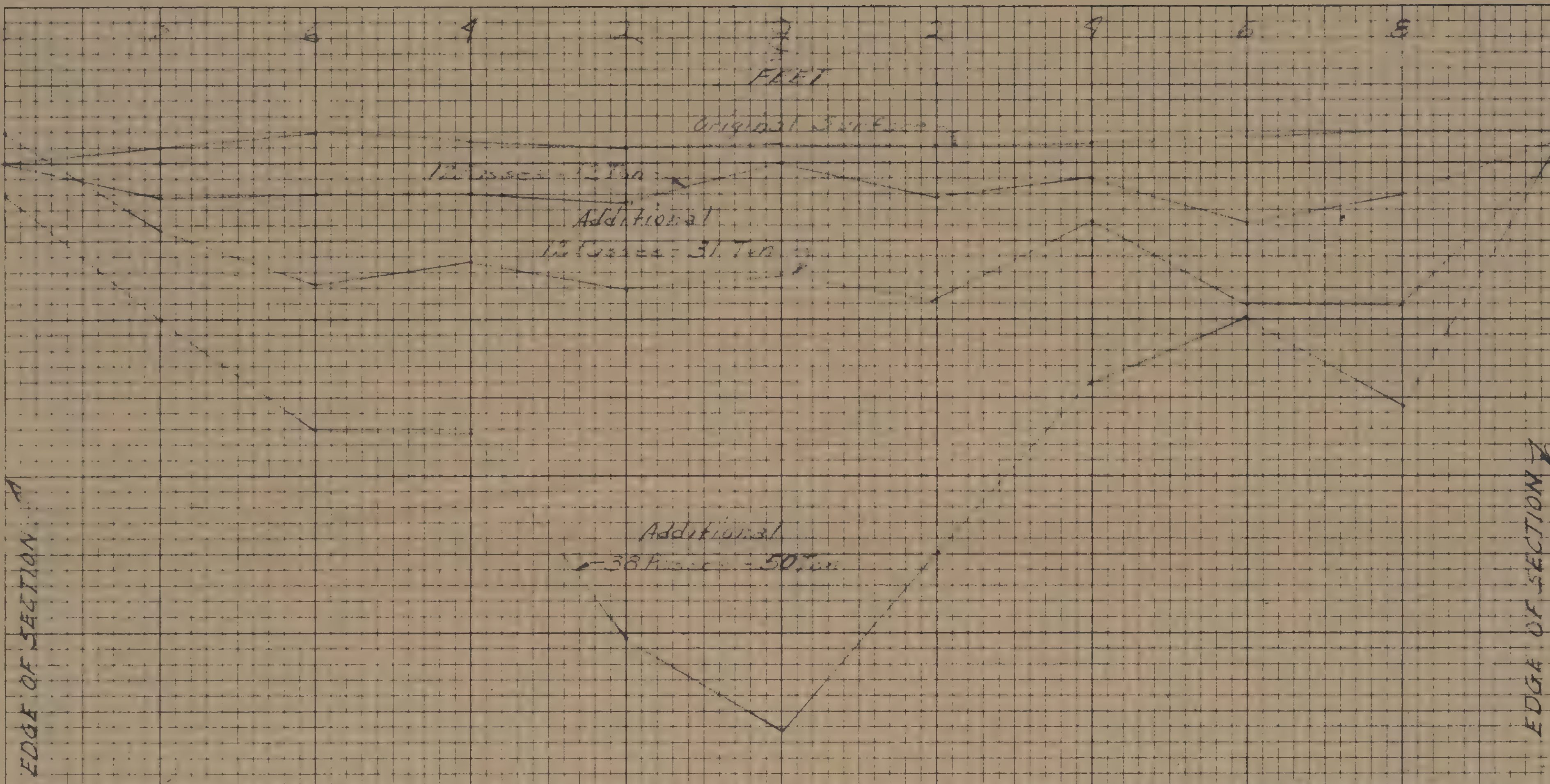
FIG. B-40



CROSS SECTION PROFILE
STA. 59+25 TEST STRIP 3

SCALE: VERTICAL 1" = 1'
HORIZONTAL 1" = 2'

STATE OF NEW YORK
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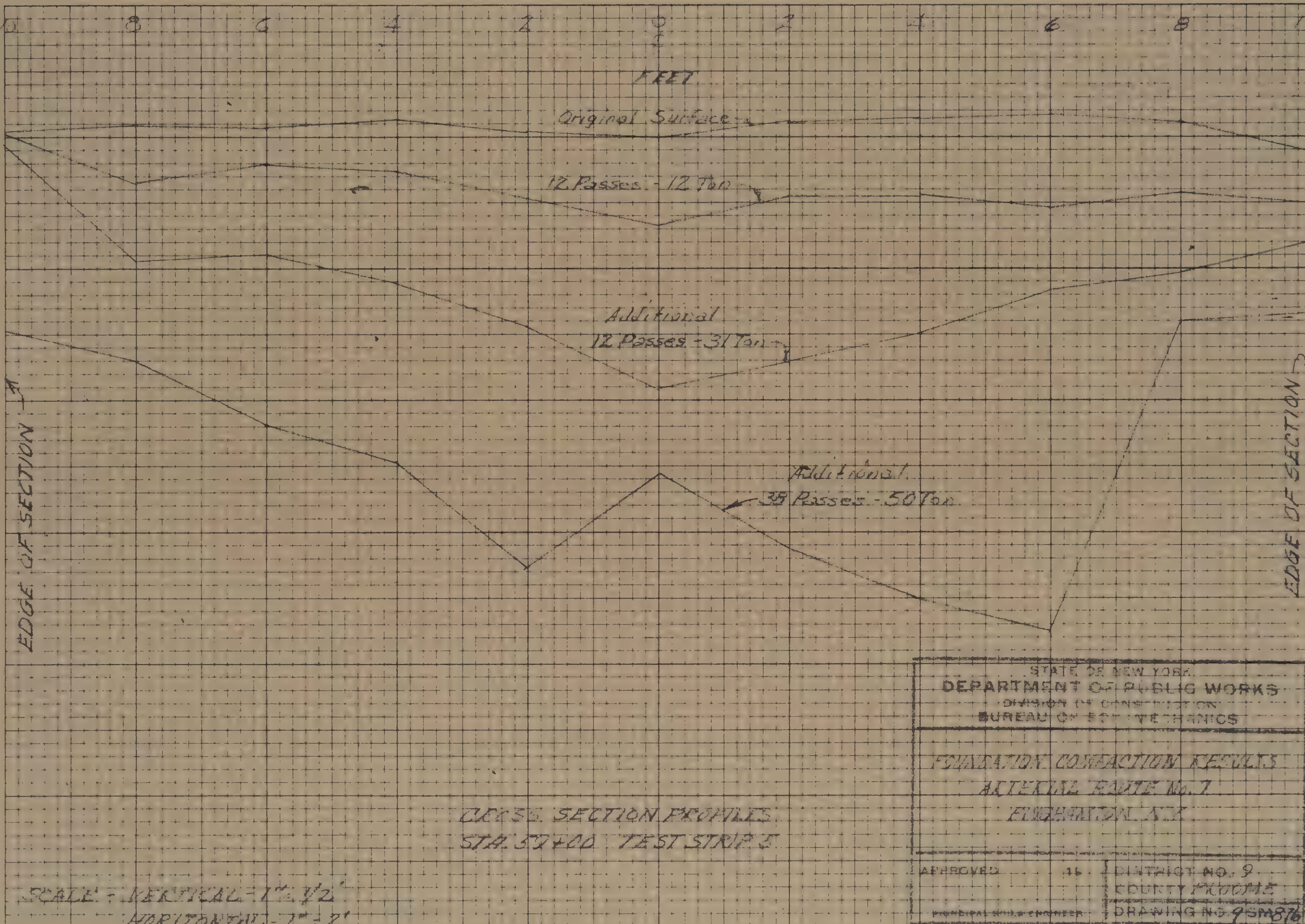
DIVISION OF CONSTRUCTION
BUREAU OF SOIL MECHANICS

FOUNDATION COMPACTION RESULTS
ARTERIAL ROUTE
BATAVIA, N.Y.

APPROVED 19
PRINCIPAL SOILS ENGINEER

DISTRICT NO. 9
COUNTY
DRAWING NO. 9 SM876

Fig. C-41


FEET
Original Surface
12 Passes - 12 Ton
Additional
12 Passes - 31 Ton
Additional
38 Passes - 50 Ton
EDGE OF SECTION
EDGE OF SECTION
CROSS SECTION PROFILES
STA. 57+00 TEST STRIP 5
SCALE - VERTICAL - 1" = 1/2'
HORIZONTAL - 1" = 2'
STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
BUREAU OF SOIL MECHANICS
APPROVED
DISTRICT NO. 9
DRAWING NO. 9SM876

NO. 340-10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH

EUGENE DIETZGEN CO.
MADE IN U.S.A.

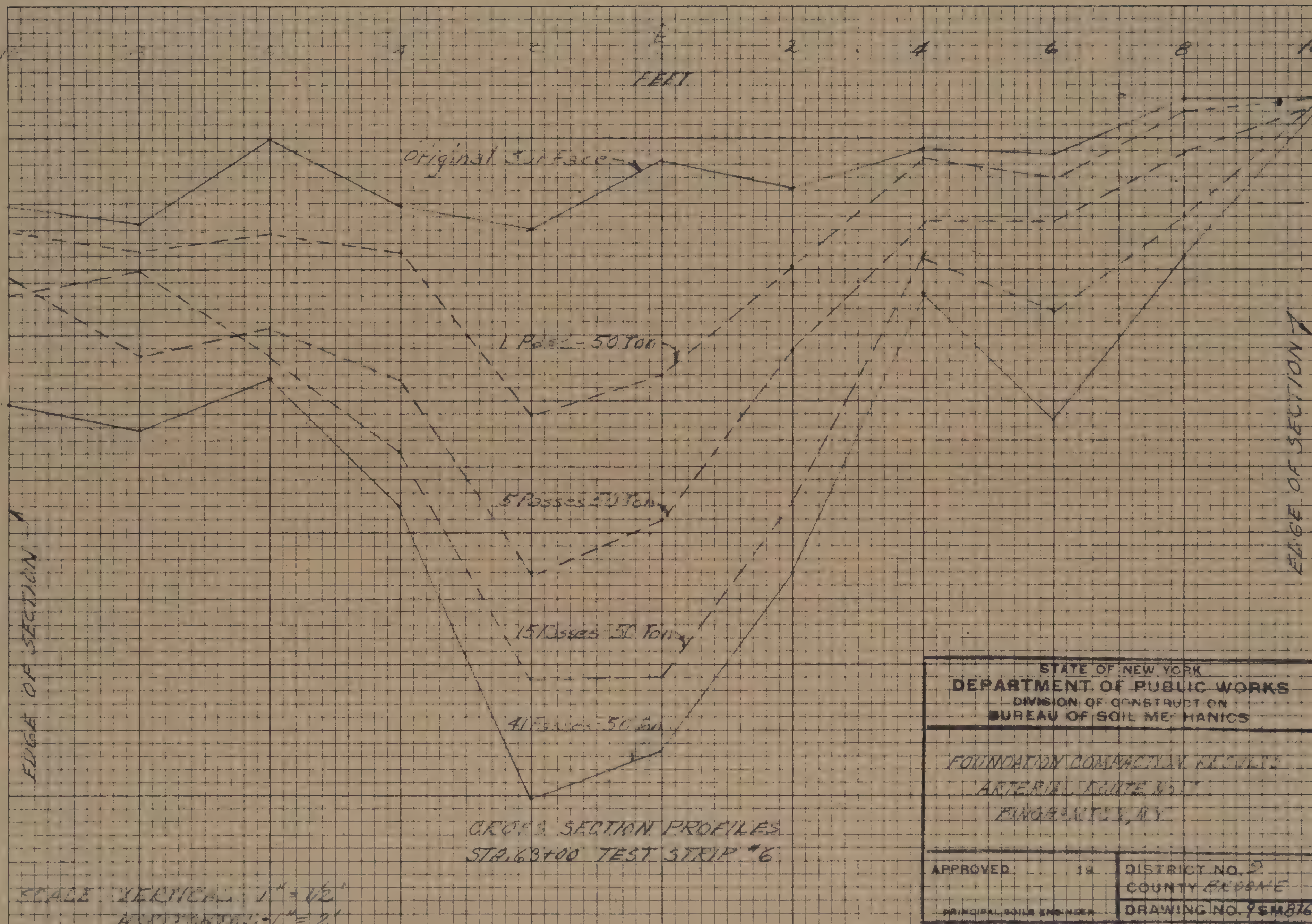


FIG. B-42

NO. 340-10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH

EUGENE DIETZGEN CO.
MADE IN U. S. A.

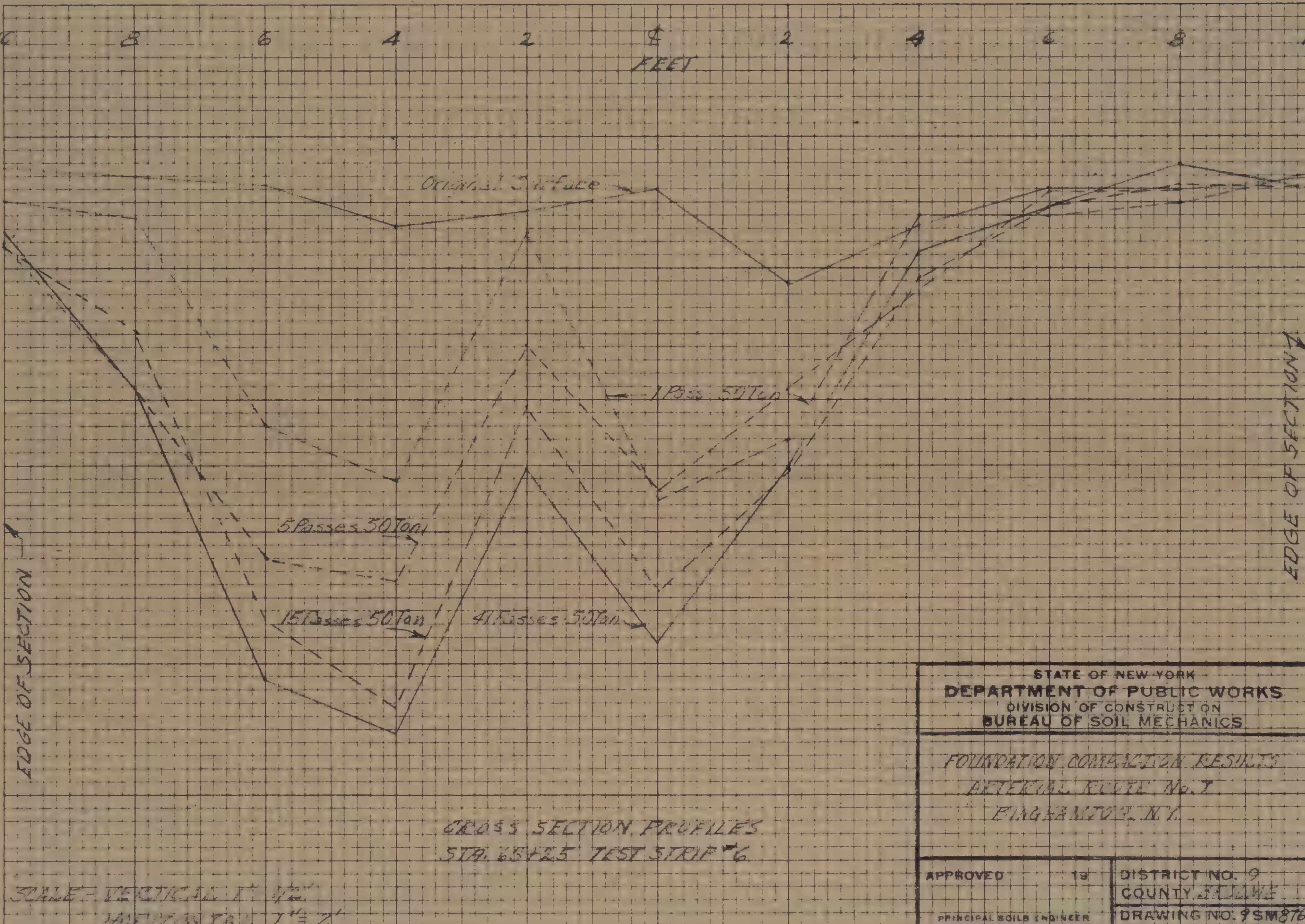


FIG. B-43

NO. 340-10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH

EUGENE DIETZGEN CO.
MADE IN U. S. A.

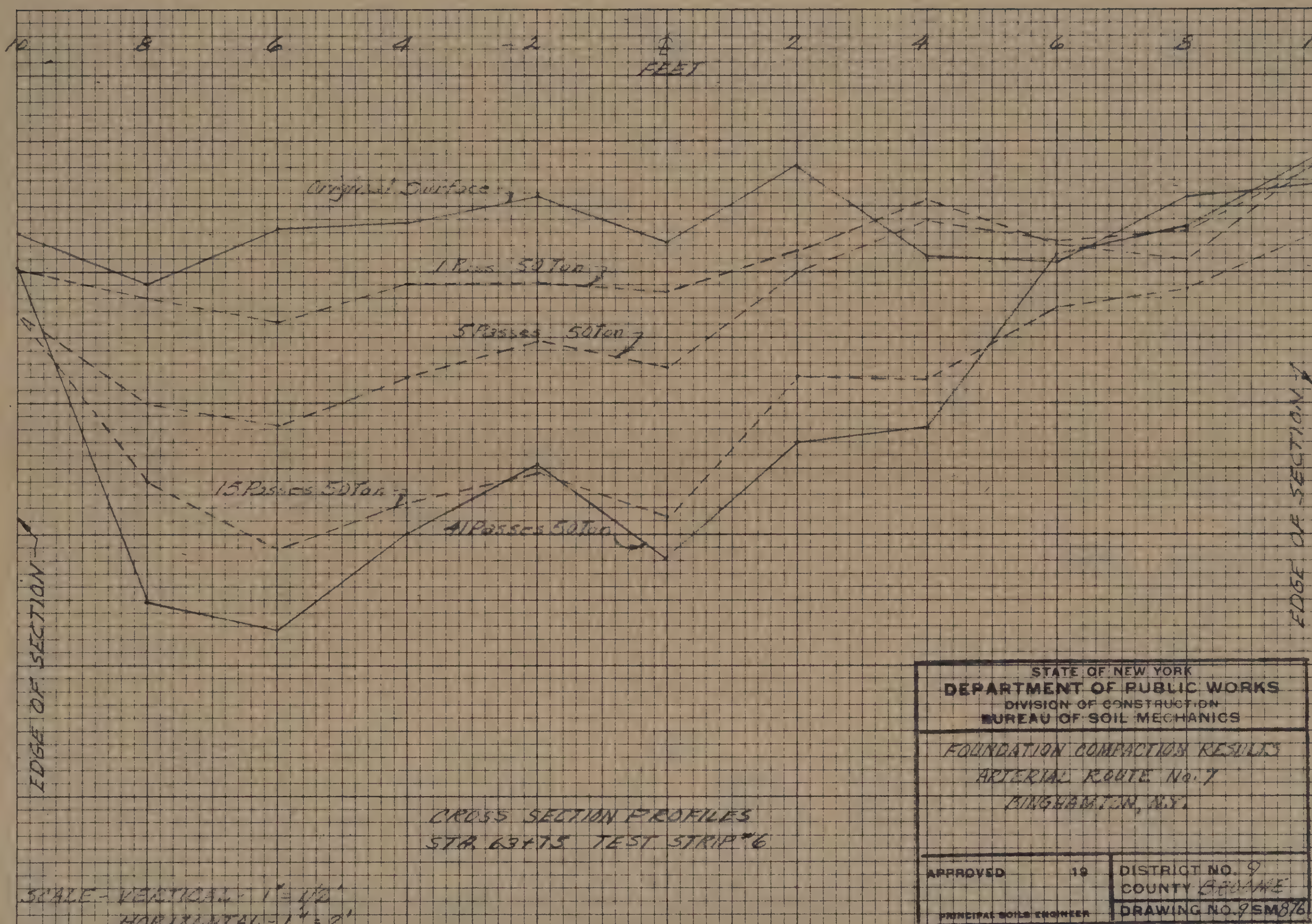


FIG. B-44

NO. 340-10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH

EUGENE DIETZGEN CO.
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FIG. B-45

T.S. #6

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DIVISION OF CONSTRUCTION
BUREAU OF SOIL MECHANICS

FOUNDATION COMPACTION RESULTS
ARTERIAL ROUTE No. 7
BINGHAMTON, N.Y.

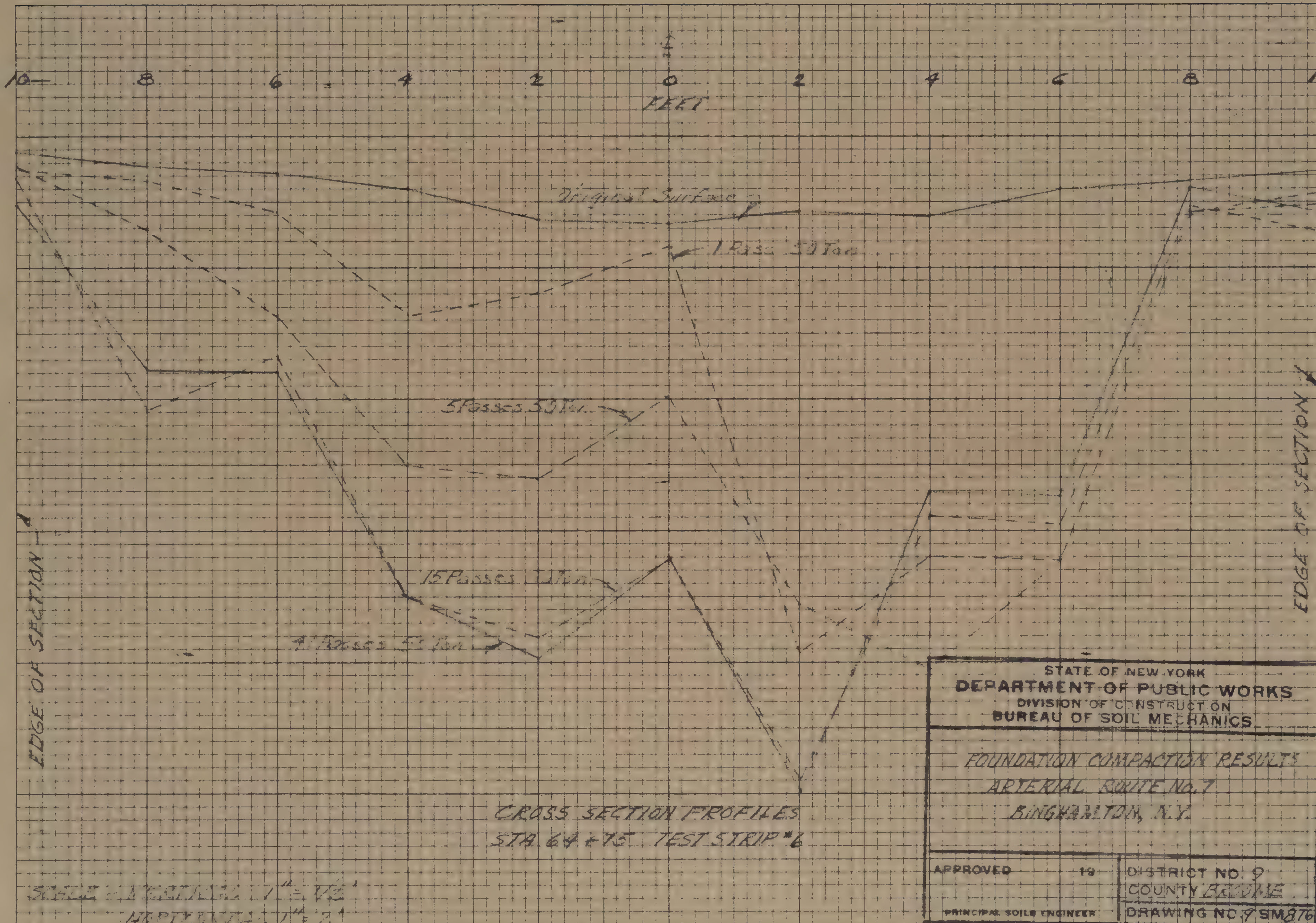
APPROVED 19

PRINCIPAL SOILS ENGINEER

DISTRICT NO. 9
COUNTY BROOME
DRAWING NO. 9 SM876

NO. 340-10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH

EUGENE DIETZGEN CO.
MADE IN U. S. A.



STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
DIVISION OF CONSTRUCTION
BUREAU OF SOIL MECHANICS

FOUNDATION COMPACTION RESULTS
ARTERIAL ROUTE No. 7
BINGHAMTON, N.Y.

APPROVED 19	DISTRICT NO. 9
	COUNTY BROOME
PRINCIPAL SOILS ENGINEER	DRAWING NO. 9 SM876

FIG. B-46

NO. 340-10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH

EUGENE DIETZGEN CO.
MADE IN U. S. A.

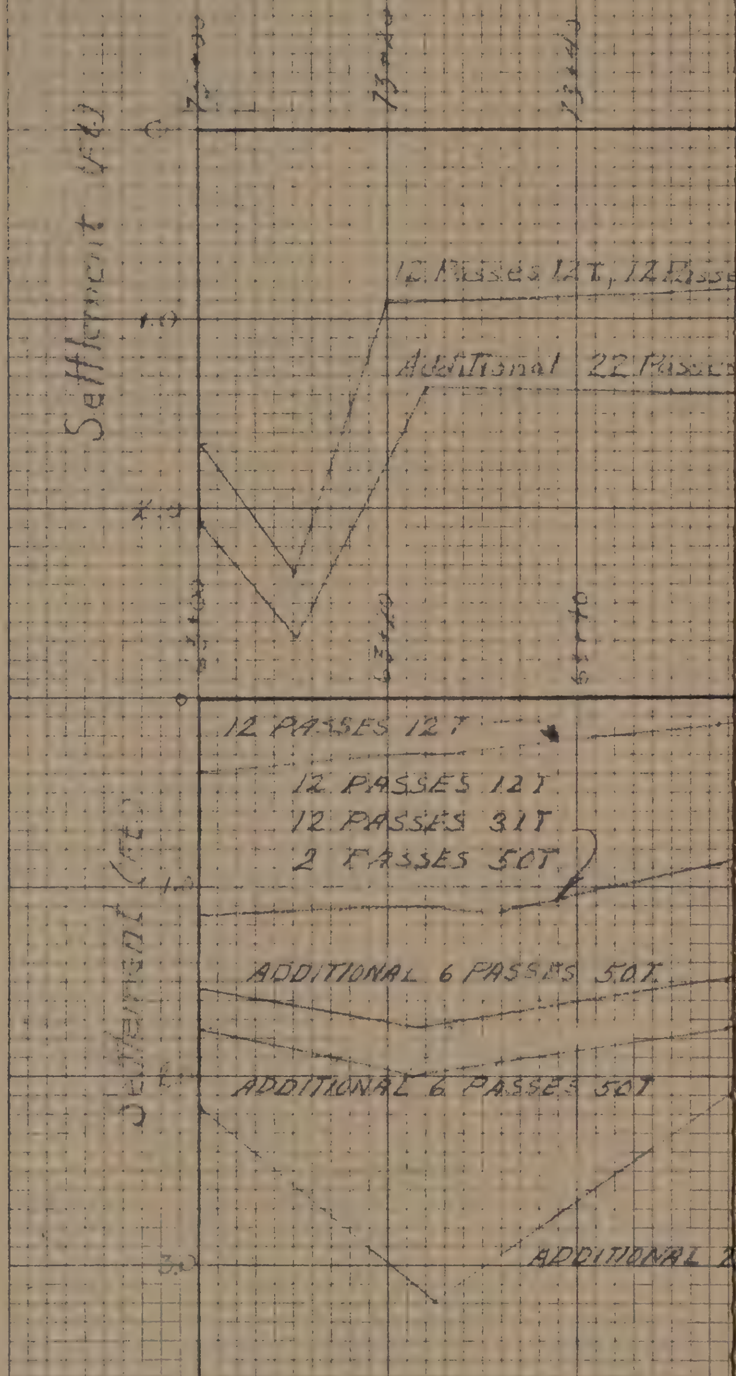
STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
DIVISION OF CONSTRUCTION
BUREAU OF SOIL MECHANICS

FOUNDATION COMPACTION RESULTS
ARTERIAL ROUTE No. 7
BINGHAMTON, N.Y.

APPROVED 19	DISTRICT NO. 9
PRINCIPAL SOILS ENGINEER	COUNTY BROOME
	DRAWING NO. 9SM876

FIG. B-47

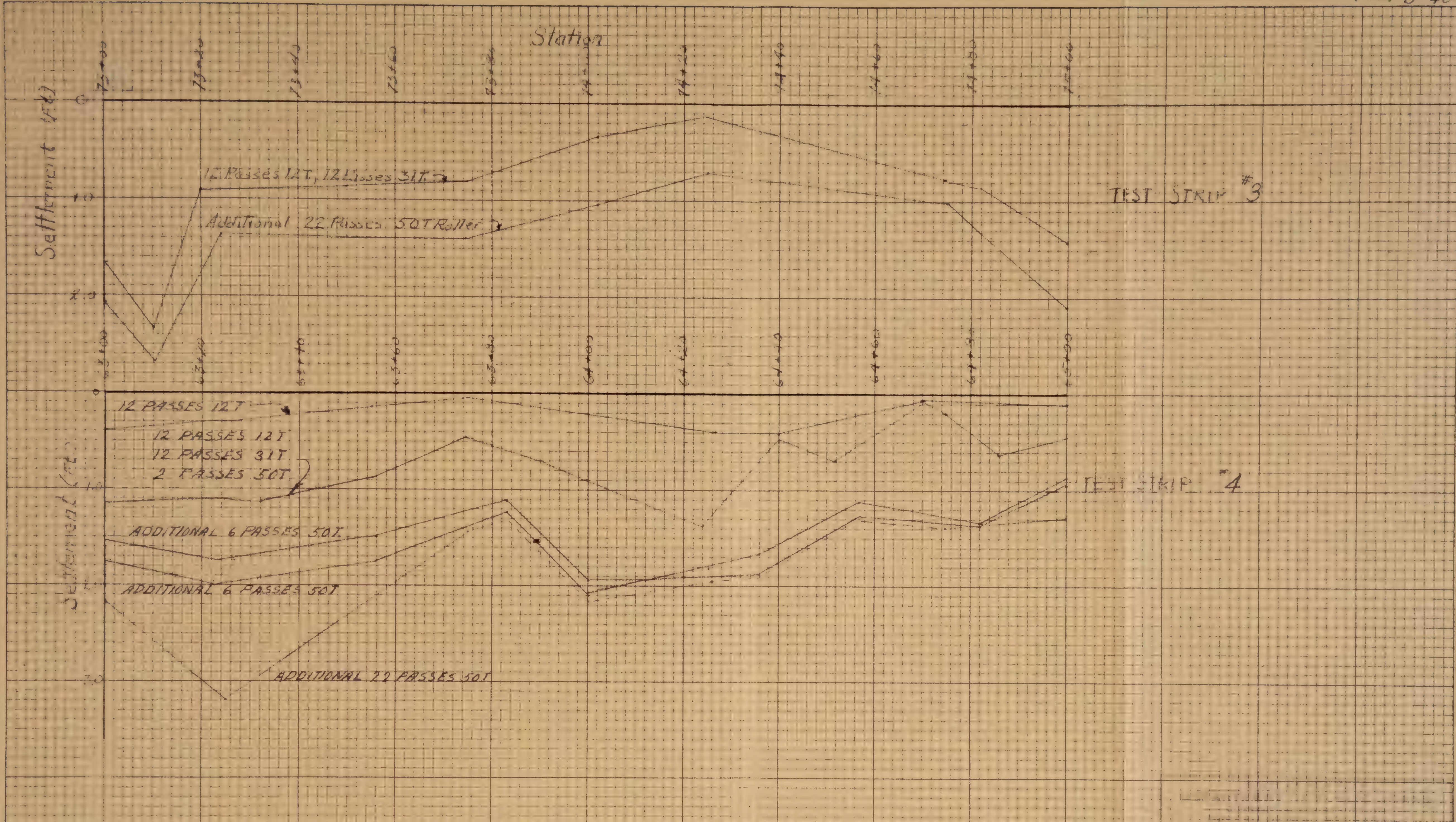
FIG. B-48



SETTLEMENT ALONG TEST STRIP ℄
VS. ROLLER PASSES
BRANDYWINE ARTERIAL (ROUTE 7)
BINGHAMTON, N.Y.

Nov 23 49 9
BROOME
9 875

FIG. B-48



SETTLEMENT ALONG TEST STRIP ℄
VS. ROLLER PASSES
BRANDYWINE ARTERIAL (ROUTE 7)
BINGHAMTON, N.Y.

Nov 23 49

9
BROOME
9-875

APPENDIX C

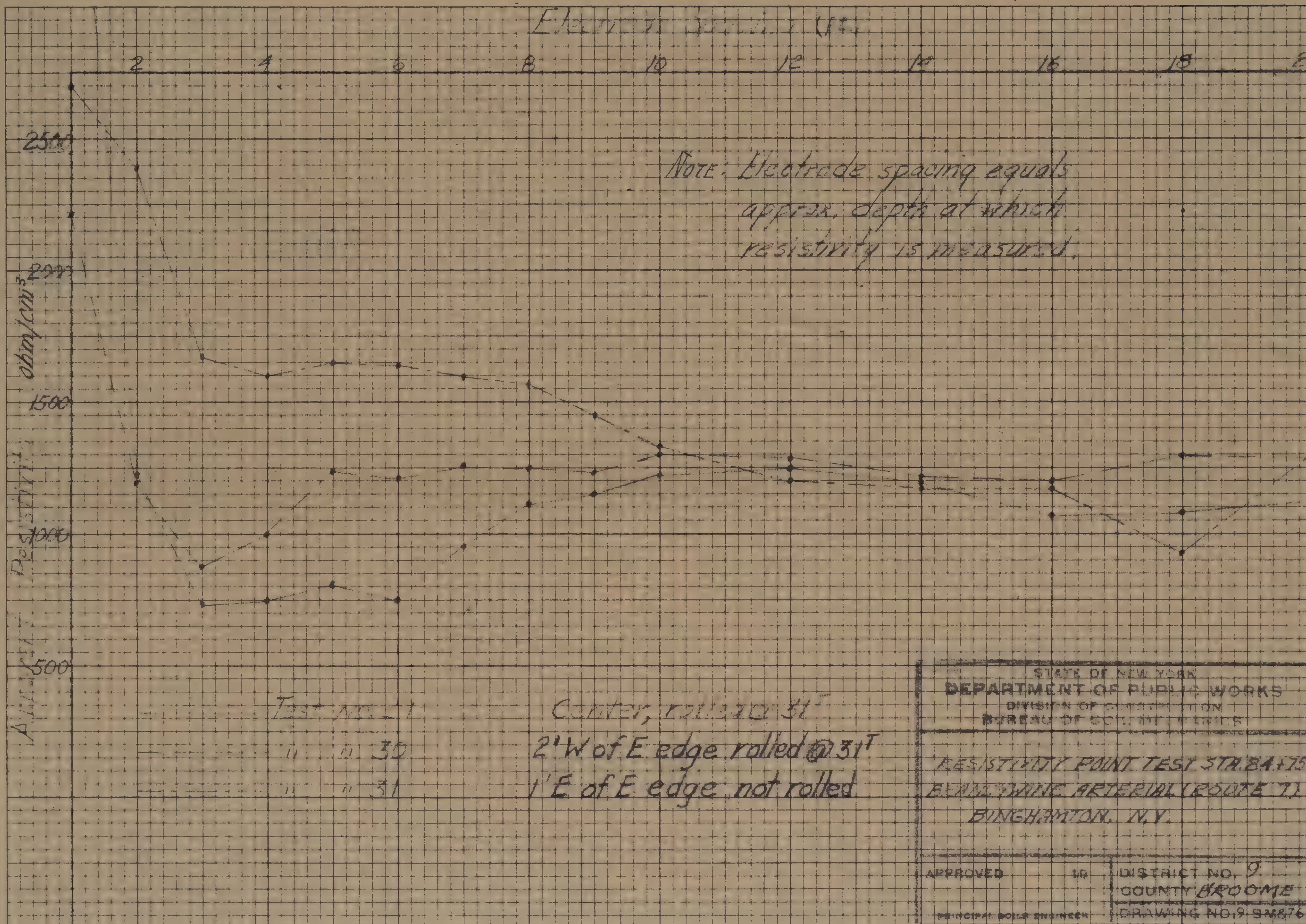

2
4
6
8
10
12
14
16
18
20
2500
2000
ohm/cm³
1500
1000
500
Note: Electrode spacing equals
approx. depth at which
resistivity is measured.
" " 30
" " 31
2' W of E edge rolled @ 31T
1' E of E edge not rolled
STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
BINGHAMTON, N.Y.
APPROVED
DISTRICT NO. 9
COUNTY BROOME
DRAWING NO. 9 SM876

Fig. C-1

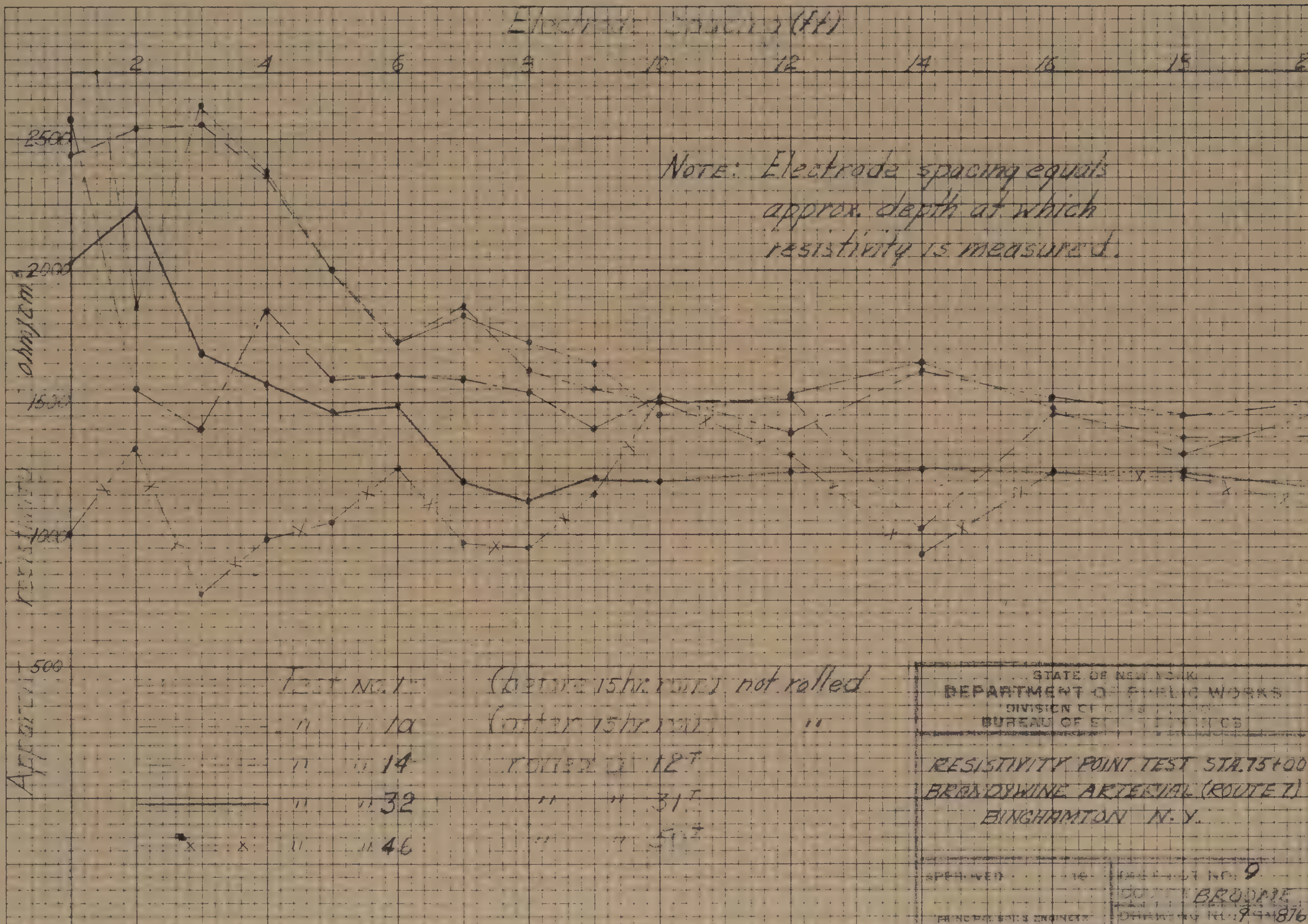

Electrode Spacing (ft)
2
4
6
8
10
12
14
16
18
20
Apparent resistivity ohms/cm
2500
2000
1500
1000
500
NOTE: Electrode spacing equals approx. depth at which resistivity is measured.
not rolled
14
32
46
STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
RESISTIVITY POINT TEST STA. 75+00
BRANDYWINE ARTERIAL (ROUTE 7)
BINGHAMTON N.Y.
9
BROOME

FIG. C-2

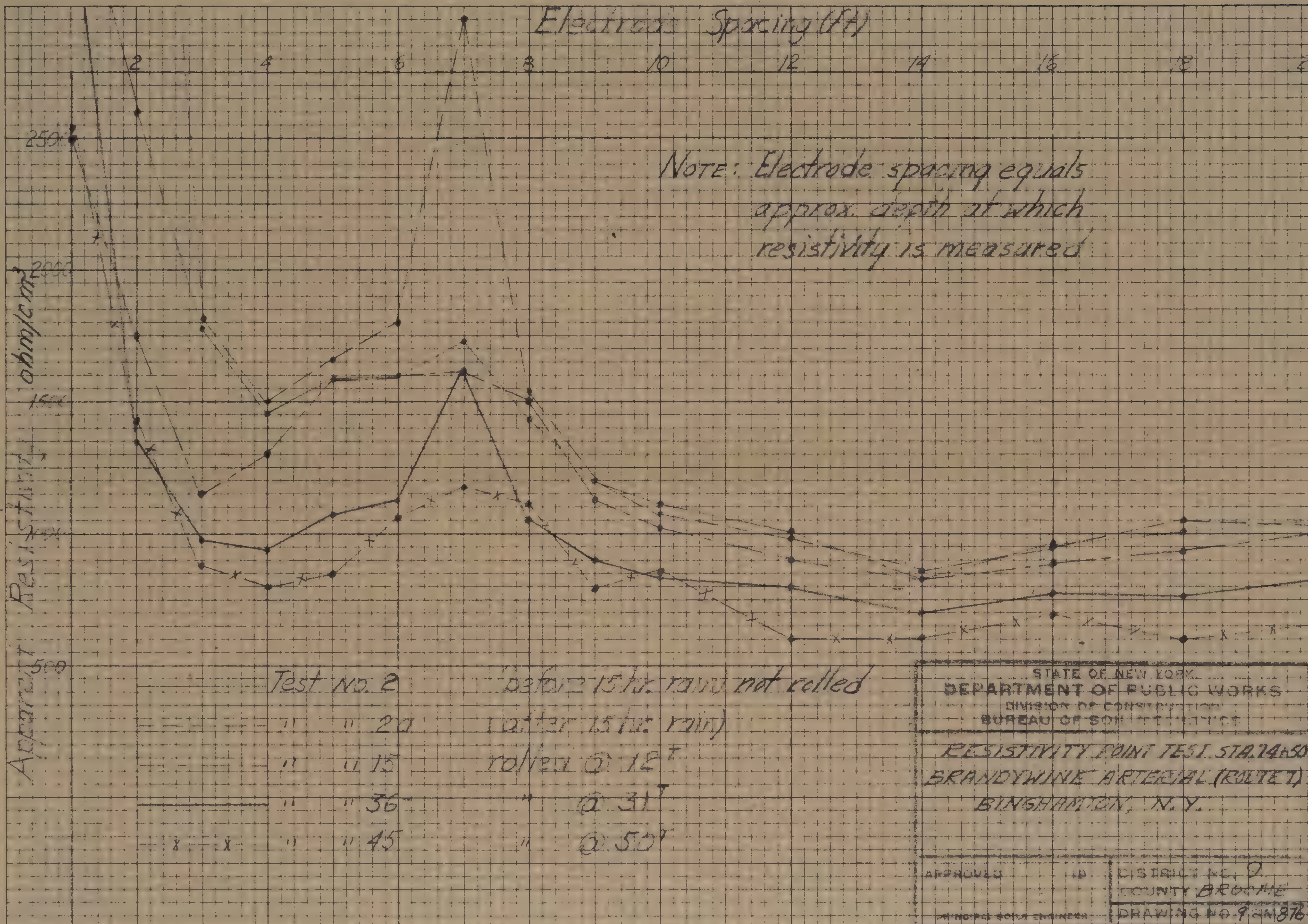
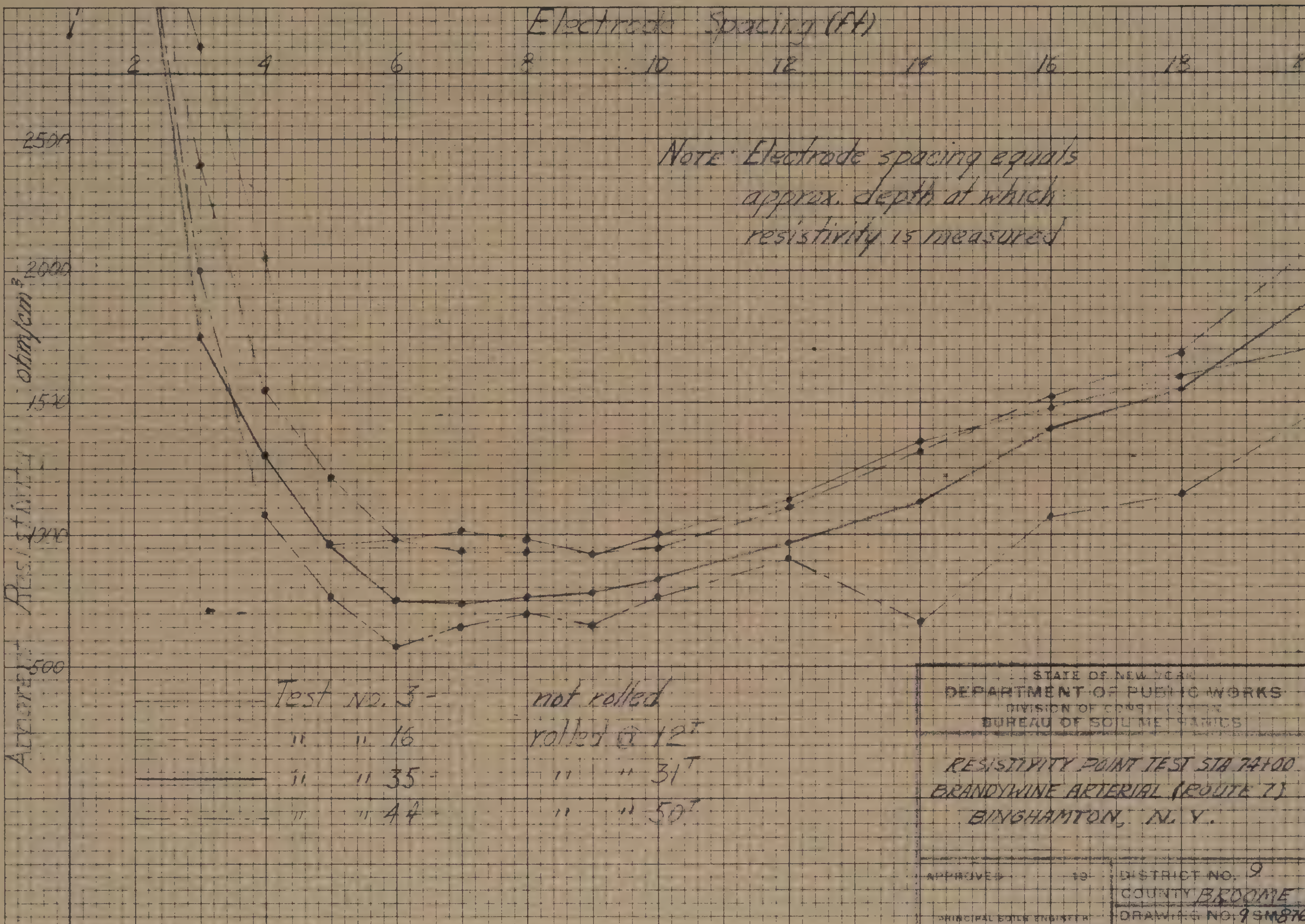

Electrode Spacing (Ft)
2
4
6
8
10
12
14
16
18
20
Apparent Resistivity ohm/cm³
2500
2000
1500
500
Note: Electrode spacing equals approx. depth at which resistivity is measured
Test No. 2 before 15 hr. rain not rolled
" " 2a (after 15 hr. rain)
" " 15 rolled @ 12T
" " 36 " @ 31T
" " 45 " @ 50T
STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
RESISTIVITY POINT TEST STA. 74+50
BRANDYWINE ARTERIAL (ROUTE 7)
BINGHAMTON, N.Y.
DISTRICT NO. 9
COUNTY BROOME
DRAWING NO. 9-SM-876

FIG. C-3



STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
DIVISION OF CONSTRUCTION
BUREAU OF SOIL MECHANICS

RESISTIVITY POINT TEST STA 74+00
BRANDYWINE ARTERIAL (ROUTE 7)
BINGHAMTON, N. Y.

APPROVED 19
PRINCIPAL SOILS ENGINEER
DISTRICT NO. 9
COUNTY BROOME
DRAWING NO. 9SM876

FIG. C-4

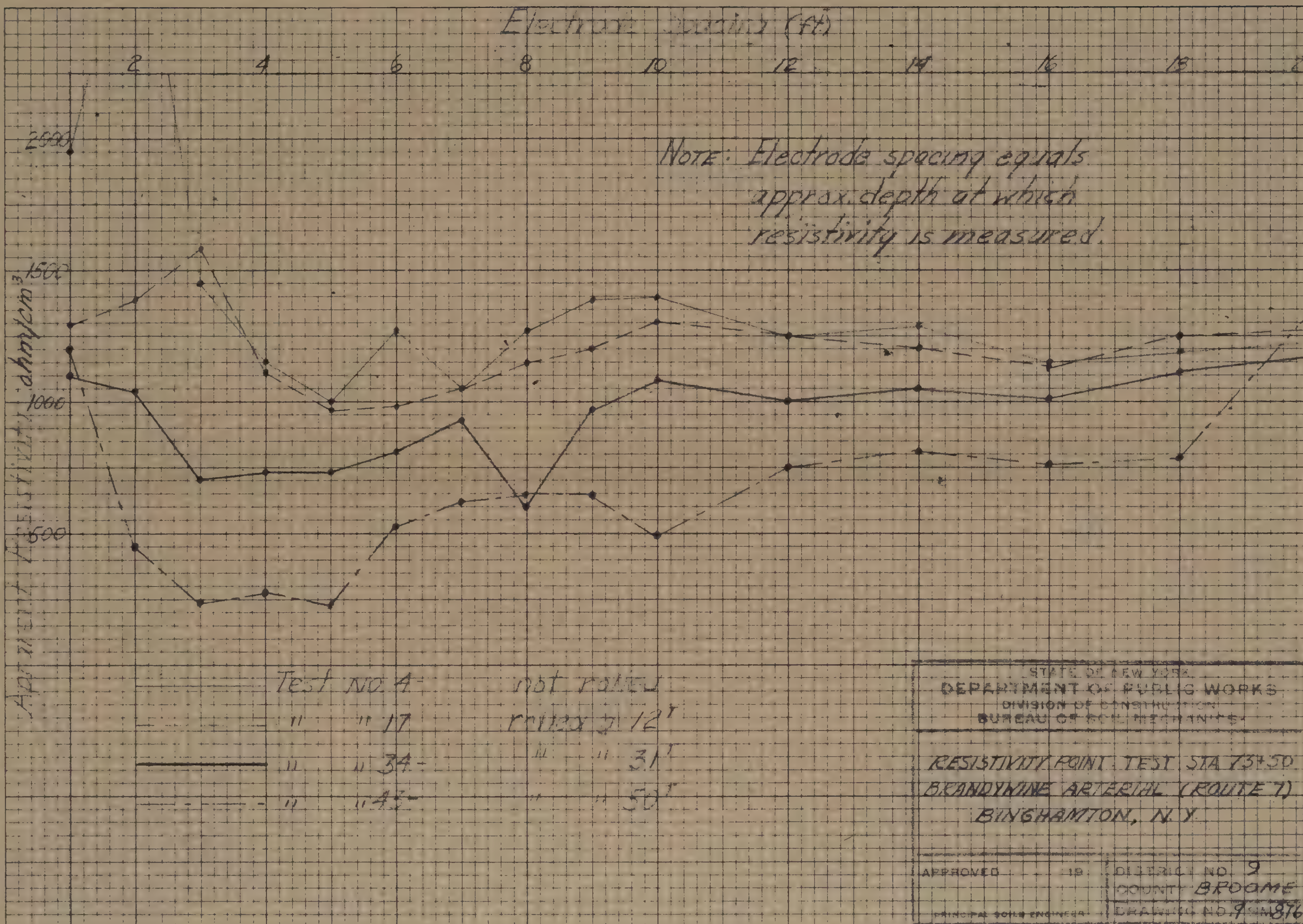

Electrode Spacing (ft)
2
4
6
8
10
12
14
16
18
20
2000
1500
1000
500
Apparent Resistivity, ohm/cm³
Note: Electrode spacing equals approx. depth at which resistivity is measured.
Test No. 4 - not rotated
" " 17 rotated 12°
" " 34 - " " 31°
" " 47 - " " 50°
STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
DIVISION OF CONSTRUCTION
BUREAU OF SOIL MECHANICS
RESISTIVITY POINT TEST STA 73+50
BRANDYWINE ARTERIAL (ROUTE 7)
BINGHAMTON, N.Y.
APPROVED 19
PRINCIPAL SOILS ENGINEER
DISTRICT NO. 9
COUNTY BROOME
DRAWING NO. 9 SM 876

FIG. C-5

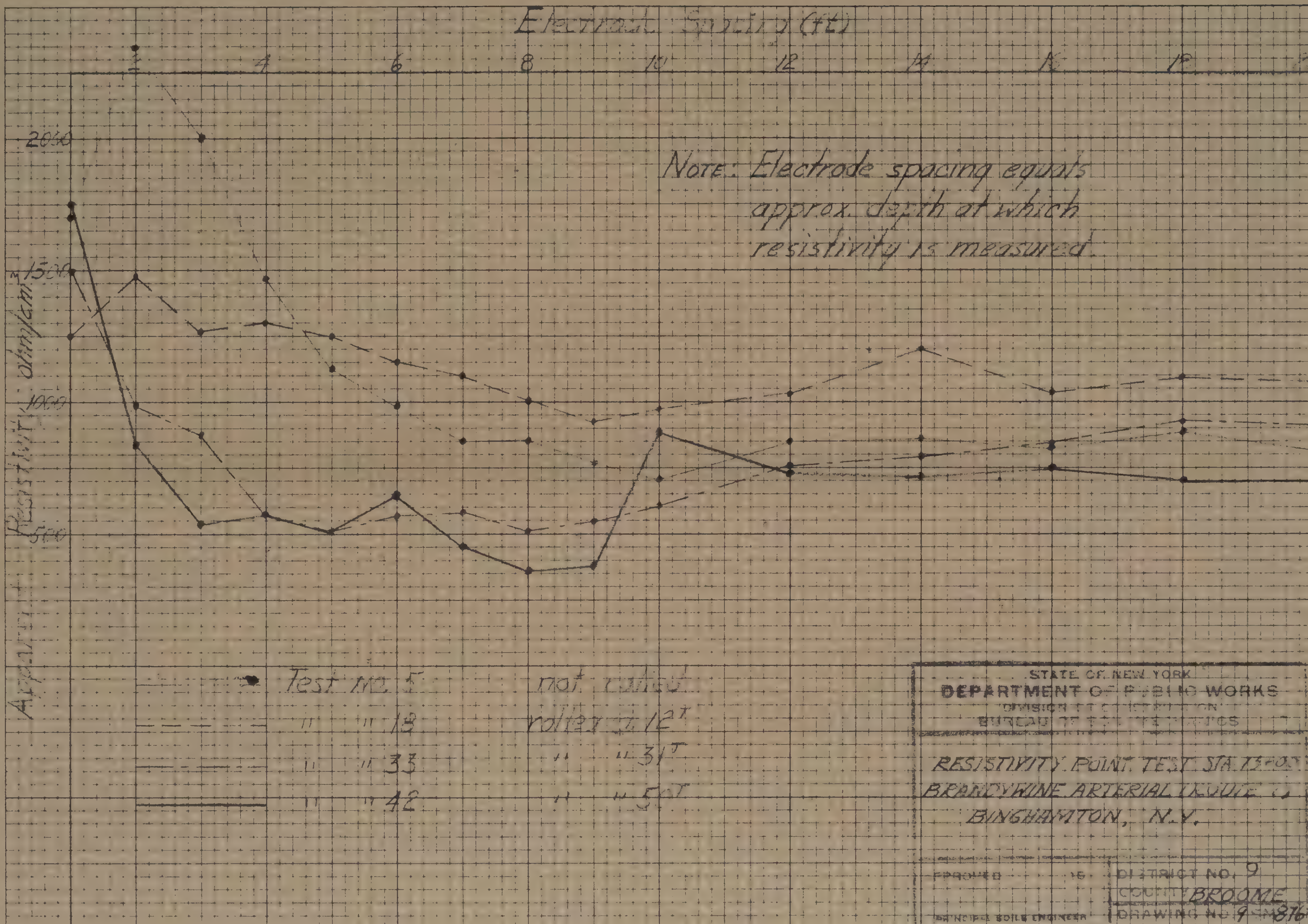

Electrode Spacing (ft)
2
4
6
8
10
12
14
16
18
2000
1500
1000
500
Apparent Resistivity ohm/cm³
Note: Electrode spacing equals approx. depth at which resistivity is measured.
Test no. 5 not rolled
" " 18 rolled 12T
" " 33 " " 31T
" " 42 " " 5T
STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
RESISTIVITY POINT TEST STA.
BRANDYWINE ARTERIAL
BINGHAMTON, N.Y.
DISTRICT NO. 9
COUNTY BROOME
DRAWING NO.

FIG. C-6


Electrode Spacing (Ft.)
2
4
6
8
10
12
14
16
18
20
Apparent Resistivity ohm/cm³
2000
1500
1000
500
Note: Electrode spacing equals approx. depth at which resistivity is measured.
Test No. 6 not rolled
" " 37 rolled 11-31
STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
DIVISION OF CONSTRUCTION
BUREAU OF SOIL MECHANICS
RESISTIVITY POINT TEST, STA
BRANDYWINE ARTERIAL (ROUTE 1)
BINGHAMPTON, N.Y.
APPROVED 19
PRINCIPAL SOILS ENGINEER
DISTRICT NO. 9
COUNTY BROOME
DRAWING NO 9SM876

FIG. C-7


Electrode Spacing (ft)
2
4
6
8
10
12
14
16
18
20
Apparent Resistivity ohm/cm³
2000
1500
1000
500
NOTE: Electrode spacing equals approx. depth at which resistivity is measured.
STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
RESISTIVITY POINT TEST STA 64+50
BRANDYWINE ARTERIAL (ROUTE 1)
BINGHAMTON, N.Y.
APPROVED
19
DISTRICT NO. 9
COUNTY Broome
DRAWING NO. 9 SM876

FIG. C-8

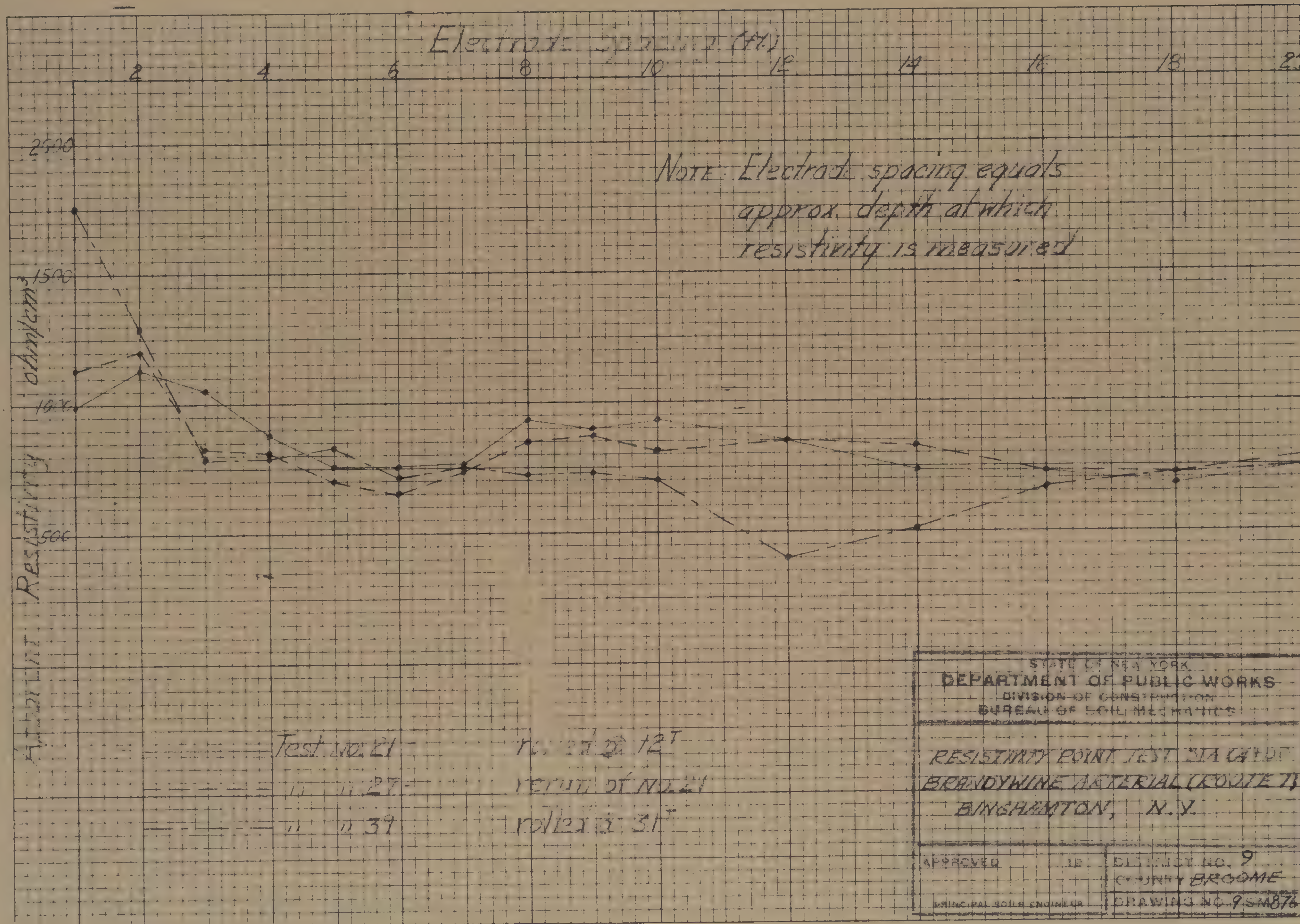

Electrode Spacing (ft.)
2
4
6
8
10
12
14
16
18
20
2500
1500
1000
500
Resistivity ohm/cm³
Note: Electrode spacing equals approx. depth at which resistivity is measured
Test No. 21
" " 27
" " 39
rerun of No. 21
STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
DIVISION OF CONSTRUCTION
BUREAU OF SOIL MECHANICS
BRANDYWINE ARTERIAL (ROUTE 7)
BINGHAMTON, N.Y.
APPROVED
PRINCIPAL SOILS ENGINEER
COUNTY BROOME
DRAWING NO. 9 SM876

Fig. C-9

NO. 340-10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH

EUGENE DIETZGEN CO.
MADE IN U. S. A.

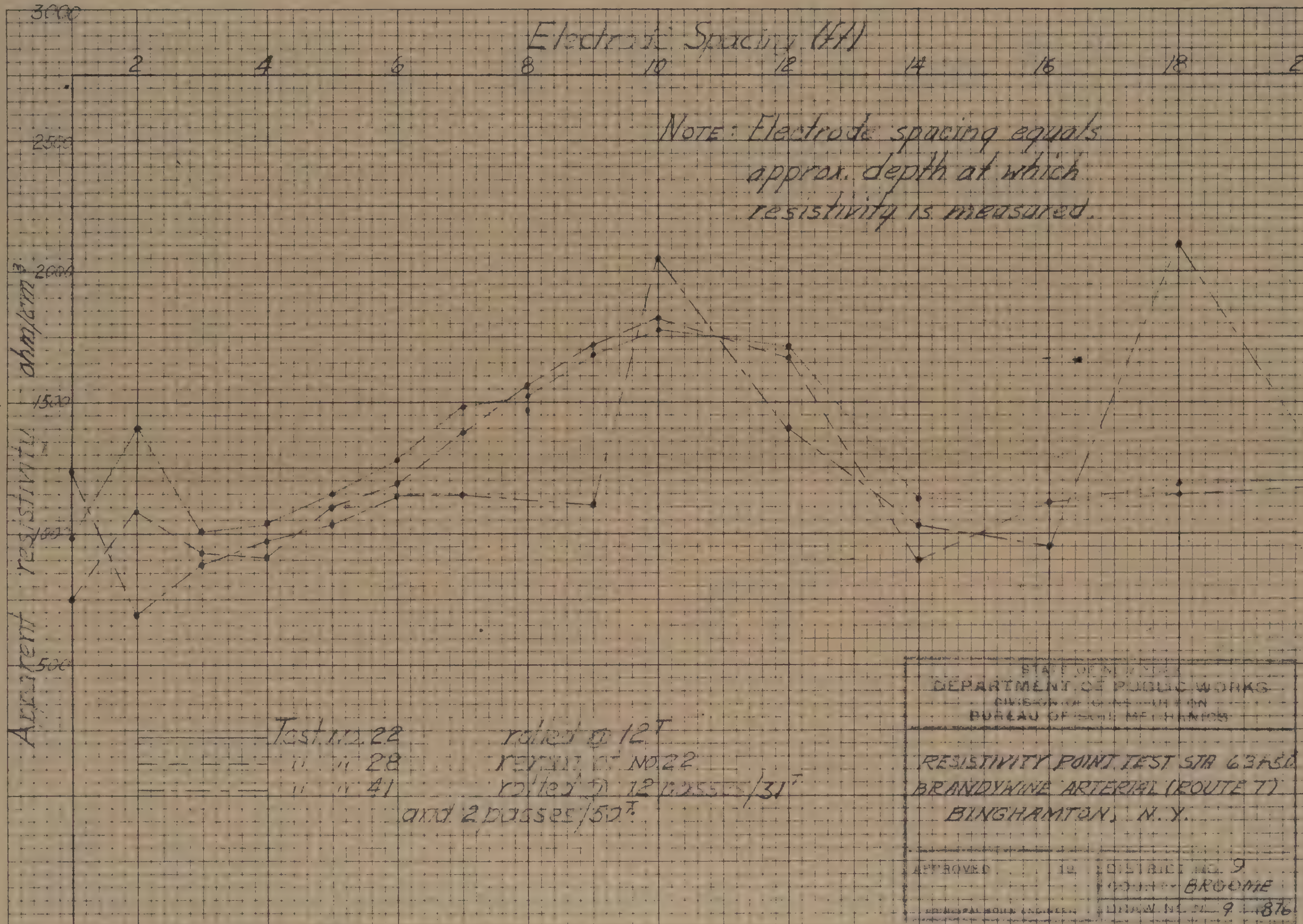


FIG. C-10

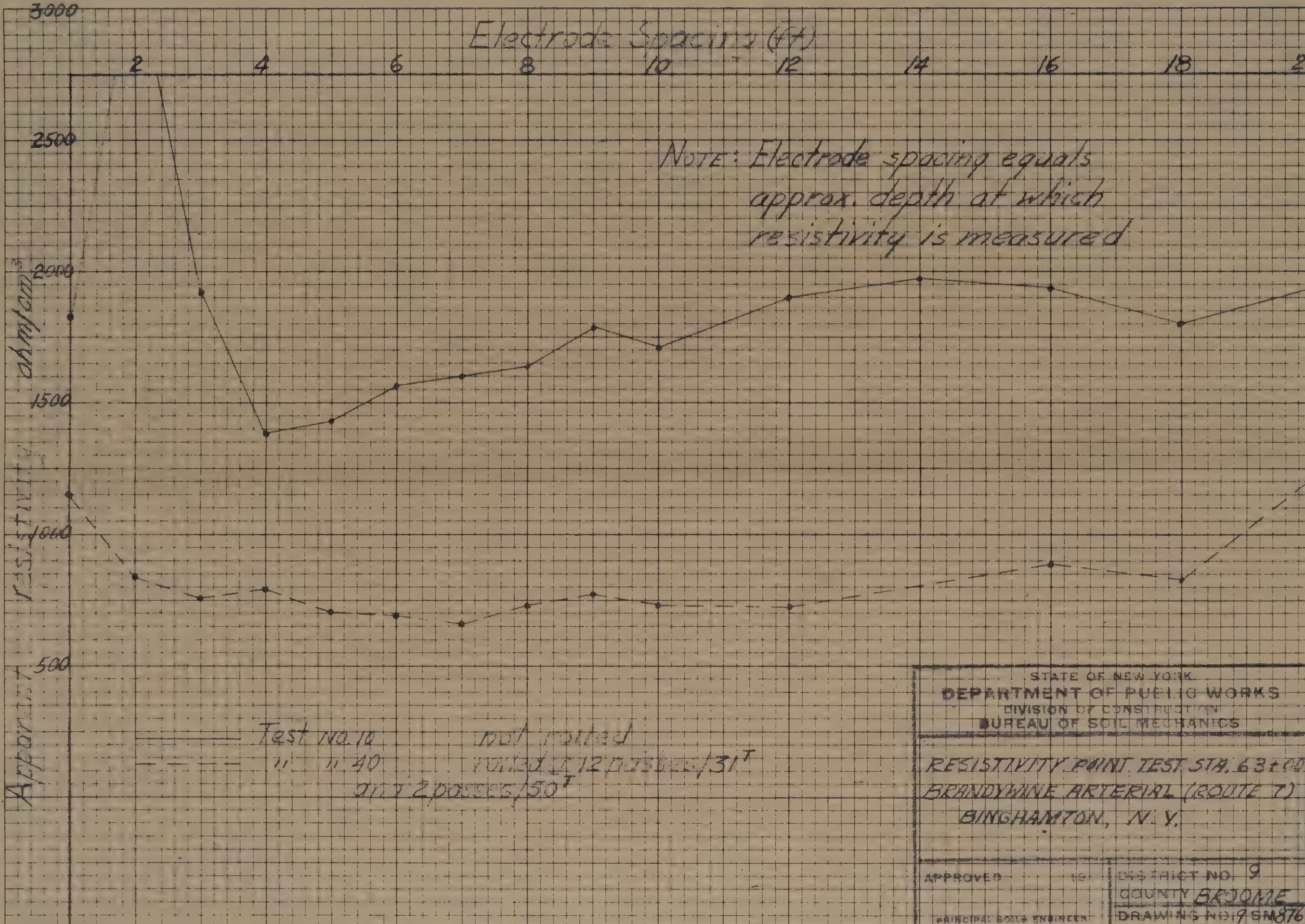

Electrode Spacing (ft)
2
4
6
8
10
12
14
16
18
20
Apparent resistivity ohm/cm³
3000
2500
2000
1500
1000
500
Note: Electrode spacing equals approx. depth at which resistivity is measured
Test No. 10 not rolled
" " 40 rolled 12 passes/31T and 2 passes/50T
STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
DIVISION OF CONSTRUCTION
BUREAU OF SOIL MECHANICS
RESISTIVITY POINT TEST STA. 63+00
BRANDYWINE ARTERIAL (ROUTE 7)
BINGHAMTON, N. Y.
APPROVED 19
PRINCIPAL SOILS ENGINEER
DISTRICT NO. 9
COUNTY BROOME
DRAWING NO. 9 SM876

FIG. C-11

FIG. C-12

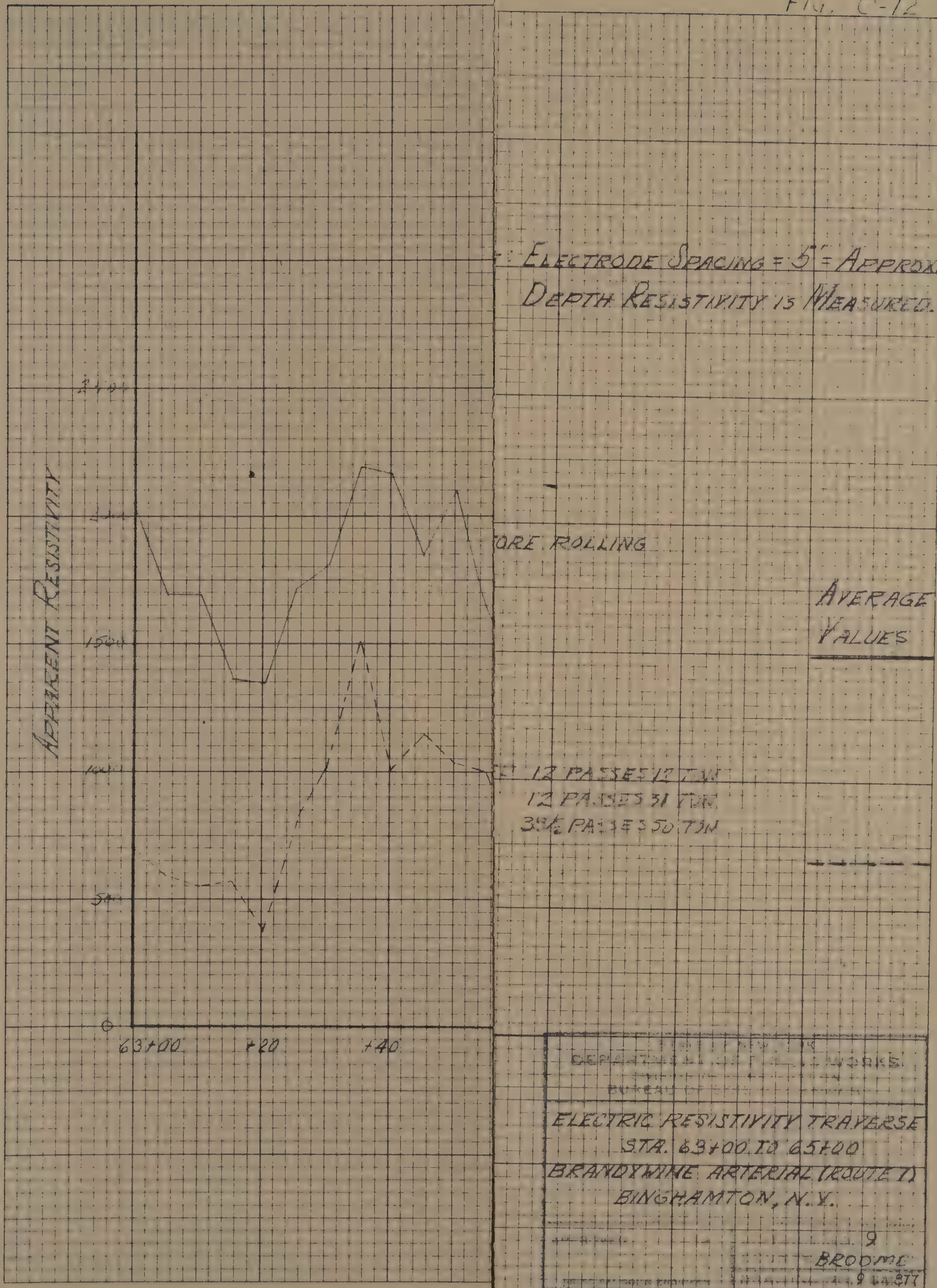

ELECTRODE SPACING = 5' = APPROX.
DEPTH RESISTIVITY IS MEASURED.
ORE ROLLING
AVERAGE
VALUES
12 PASSES 12 TON
12 PASSES 31 TON
3½ PASSES 50 TON
APPARENT RESISTIVITY
1500
500
63+00
+20
+40
WORKS
ELECTRIC RESISTIVITY TRAVERSE
STA. 63+00 TO 65+00
BRANDYWINE ARTERIAL (ROUTE 7)
BINGHAMTON, N.Y.
9
BROOME

FIG. C-12

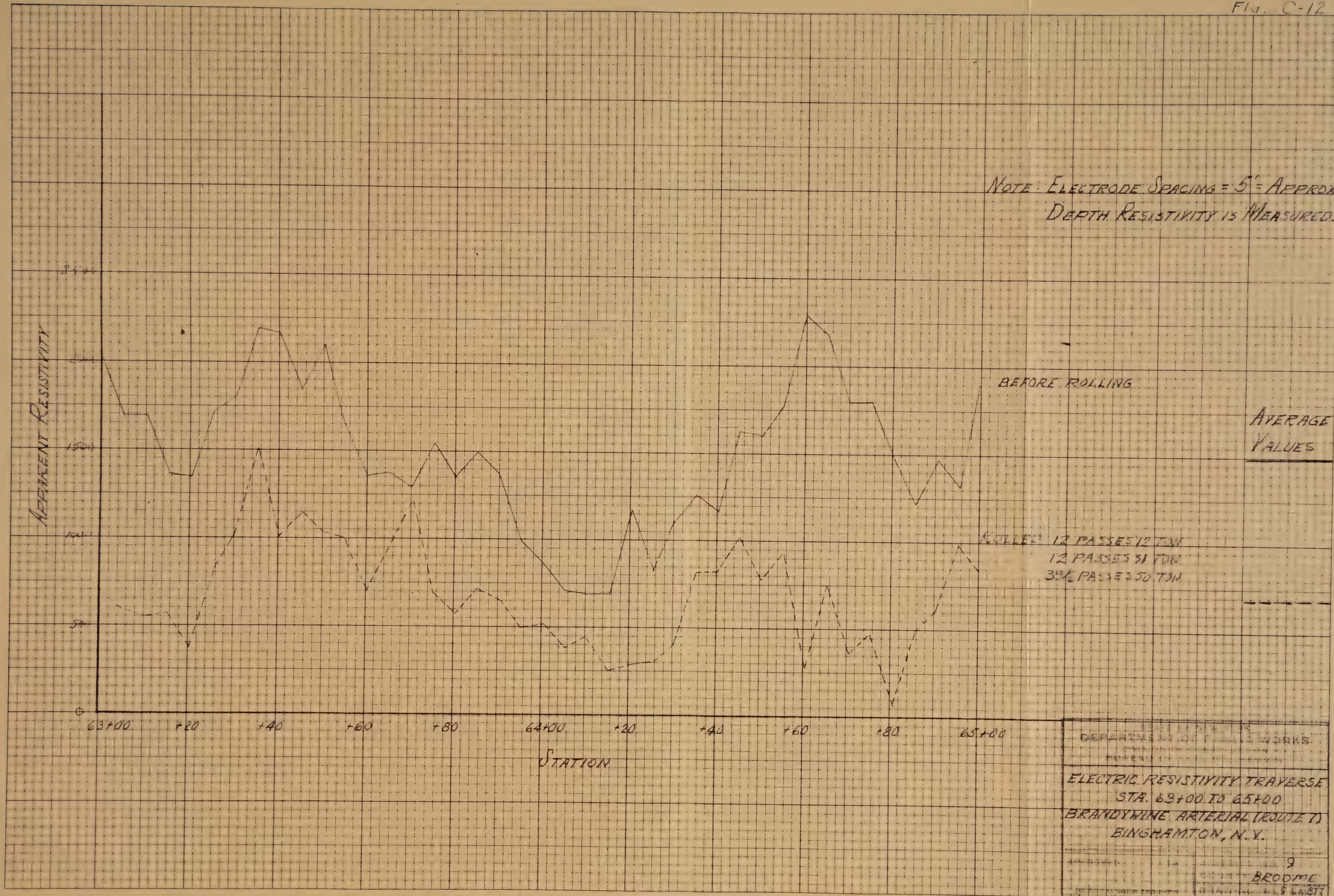
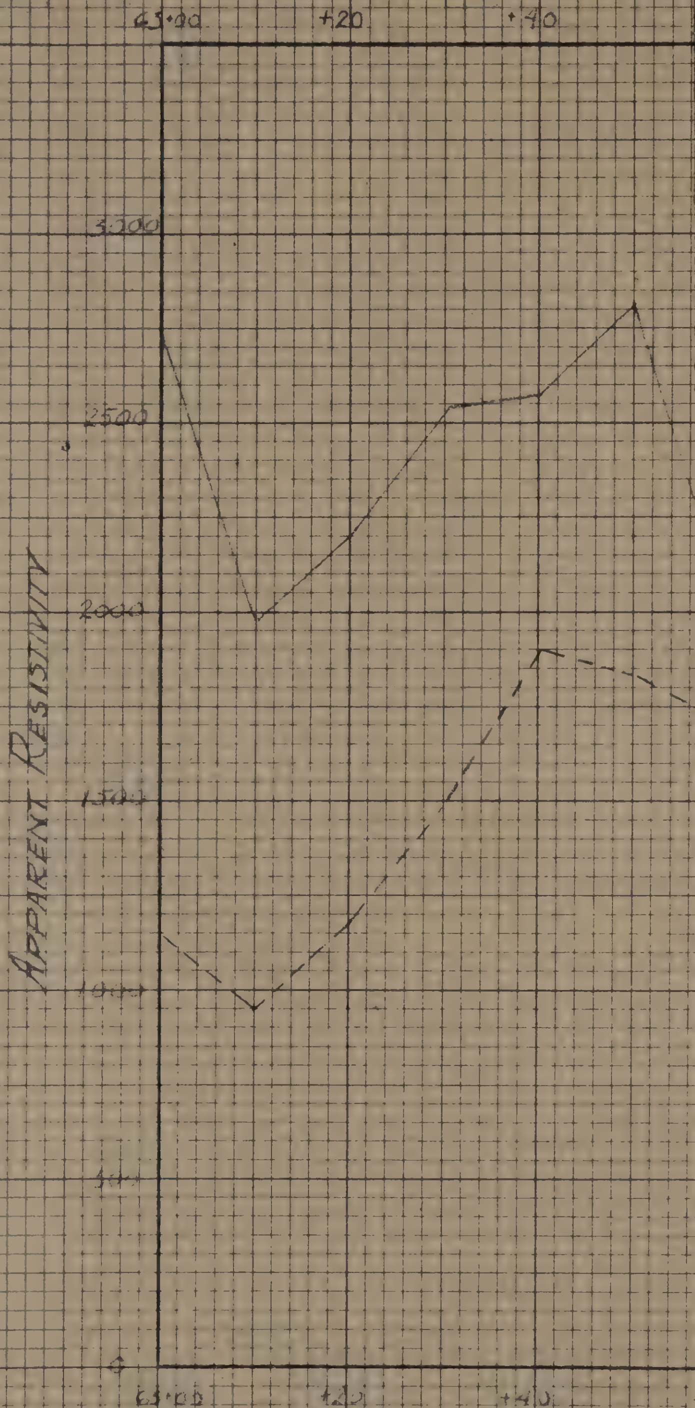

NOTE: ELECTRODE SPACING = 5' = APPROX.
DEPTH RESISTIVITY IS MEASURED.
APPARENT RESISTIVITY
1500
1000
0
63+00
+20
+40
+60
+80
64+00
+20
+40
+60
+80
65+00
STATION
BEFORE ROLLING
12 PASSES 12 TON
12 PASSES 31 TON
AVERAGE
VALUES
ELECTRIC RESISTIVITY TRAVERSE
STA. 63+00 TO 65+00
BRANDYWINE ARTERIAL (ROUTE 7)
BINGHAMTON, N.Y.
9
BROOME

FIG. C-13



NOTE: ELECTRODE SPACING = 10' = APPROX. DEPTH RESISTIVITY IS MEASURED

AVERAGE VALUES

RE ROLLING

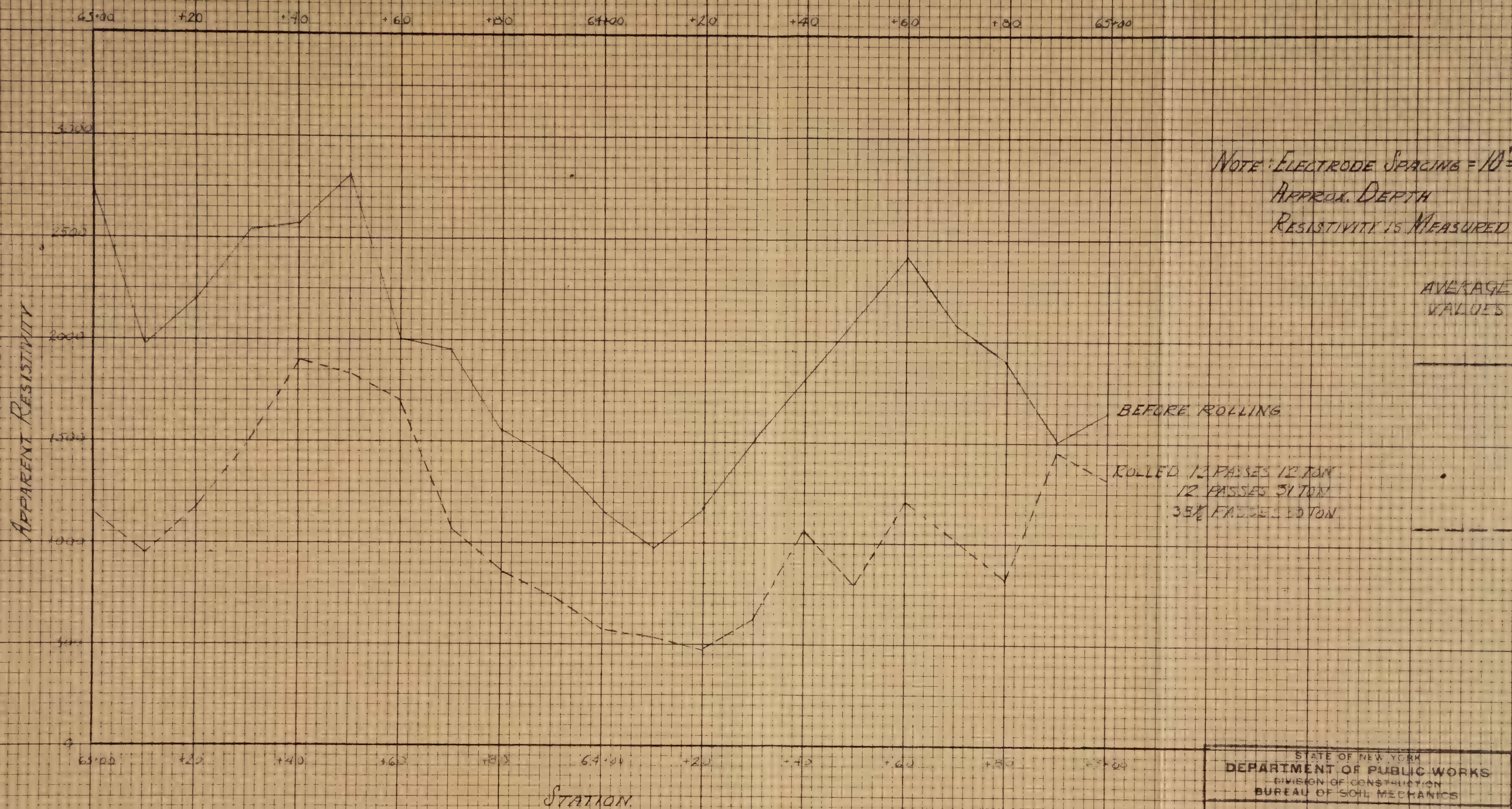
TO 13 PASSES 12 TON
12 PASSES 51 TON
35½ PASSES 10 TON

STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
DIVISION OF CONSTRUCTION
BUREAU OF SOIL MECHANICS

ELECTRIC RESISTIVITY TRAVERSE
STA. 63+00 TO 65+00
BRANDYWINE ARTERIAL (ROUTE 7)
BINGHAMTON, N.Y.

APPROVED
DISTRICT NO. 9
COUNTY BROOME
DRAWING NO. 877

FIG. C-13

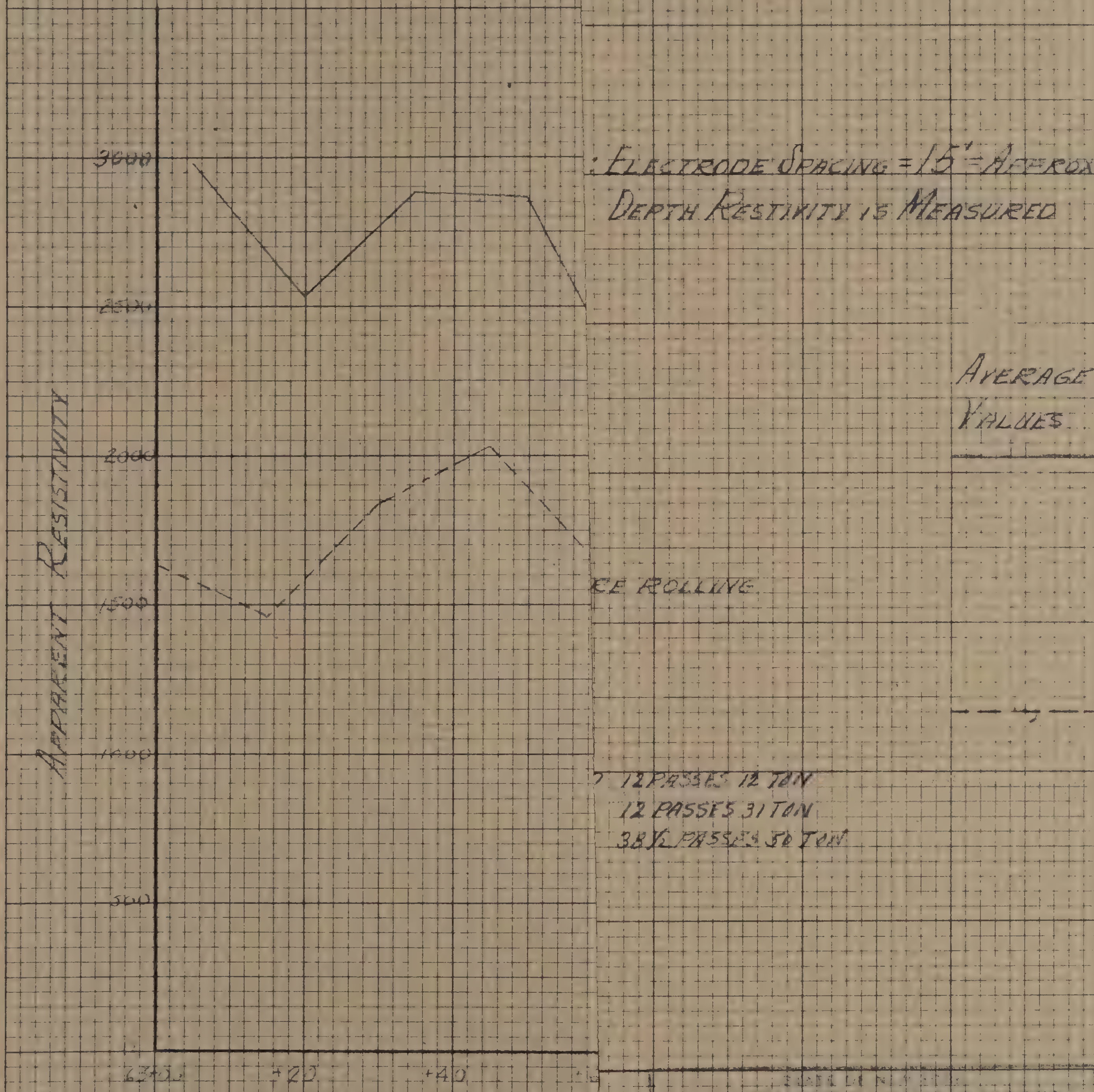


STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
DIVISION OF CONSTRUCTION
BUREAU OF SOIL MECHANICS

ELECTRIC RESISTIVITY TRAVERSE
STA. 63+00 TO 65+00
BRANDYWINE ARTERIAL (ROUTE 7)
BINGHAMTON, N.Y.

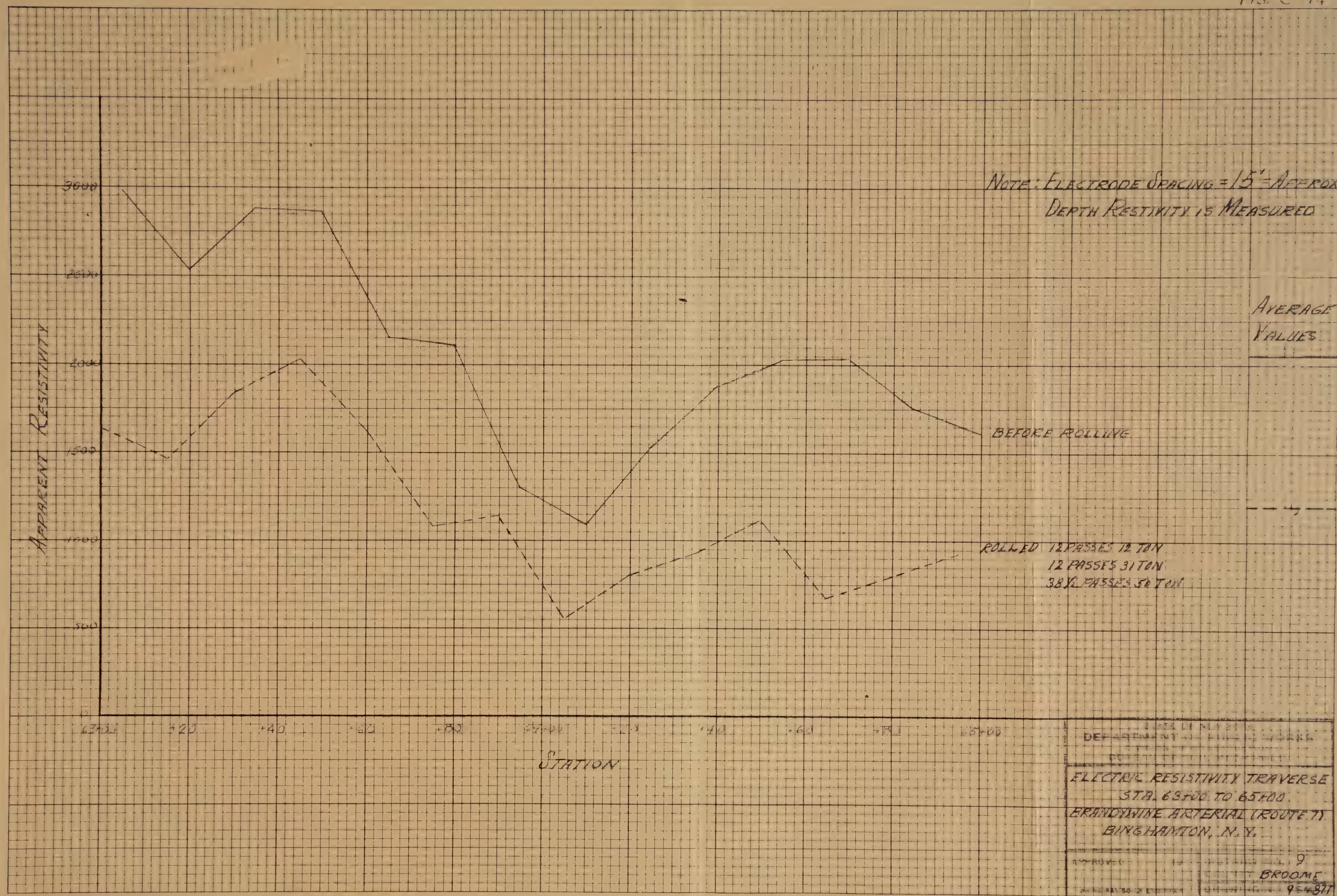
APPROVED
DISTRICT NO. 9
COUNTY BROOME
PRINCIPAL SOILS ENGINEER
DRAWING NO. 9-877

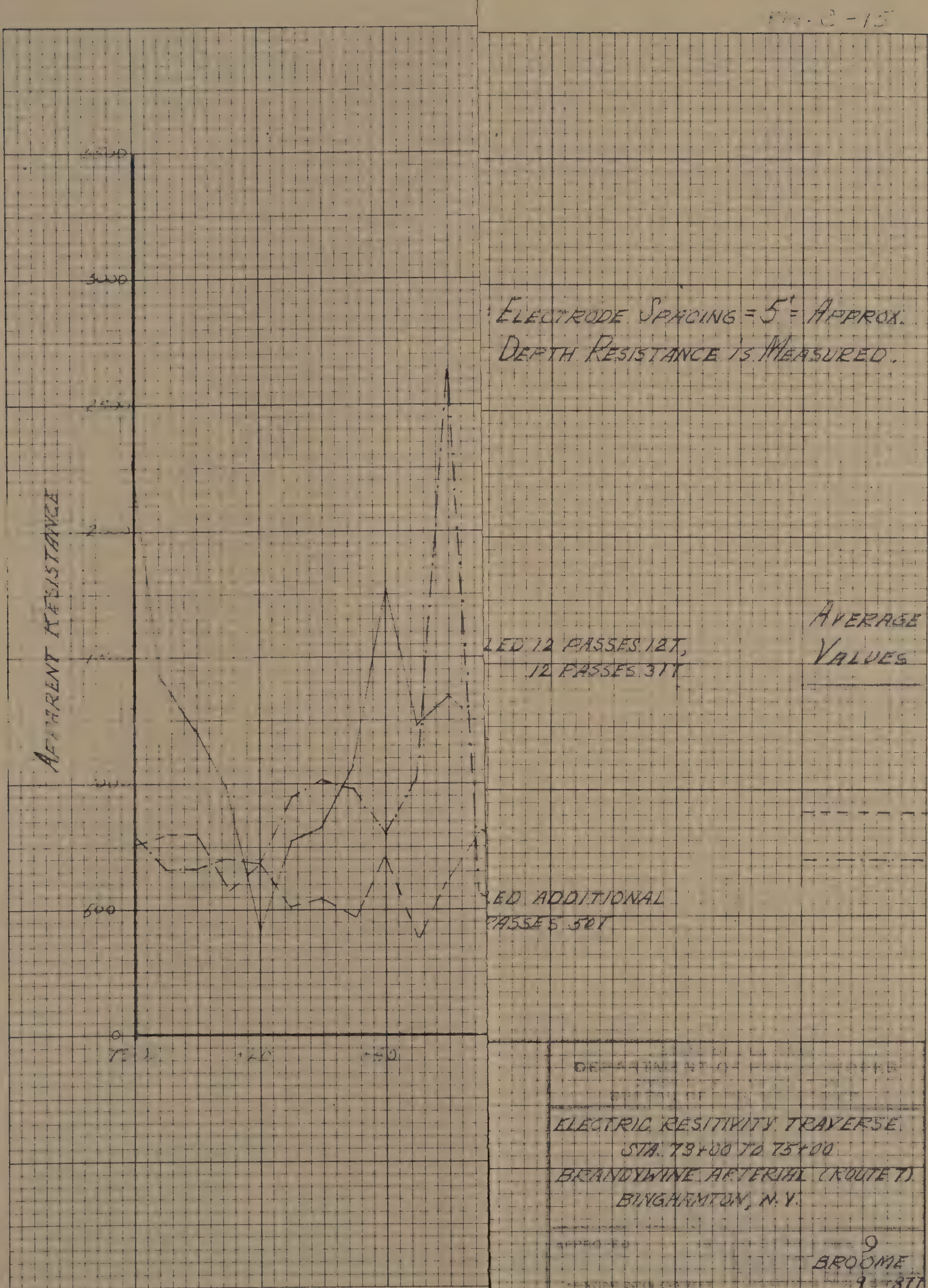
FIG. C-14



ELECTRIC RESISTIVITY TRAVERSE
STA. 63+00 TO 65+00
BRANDYWINE ARTERIAL (ROUTE 7)
BINGHAMTON, N.Y.

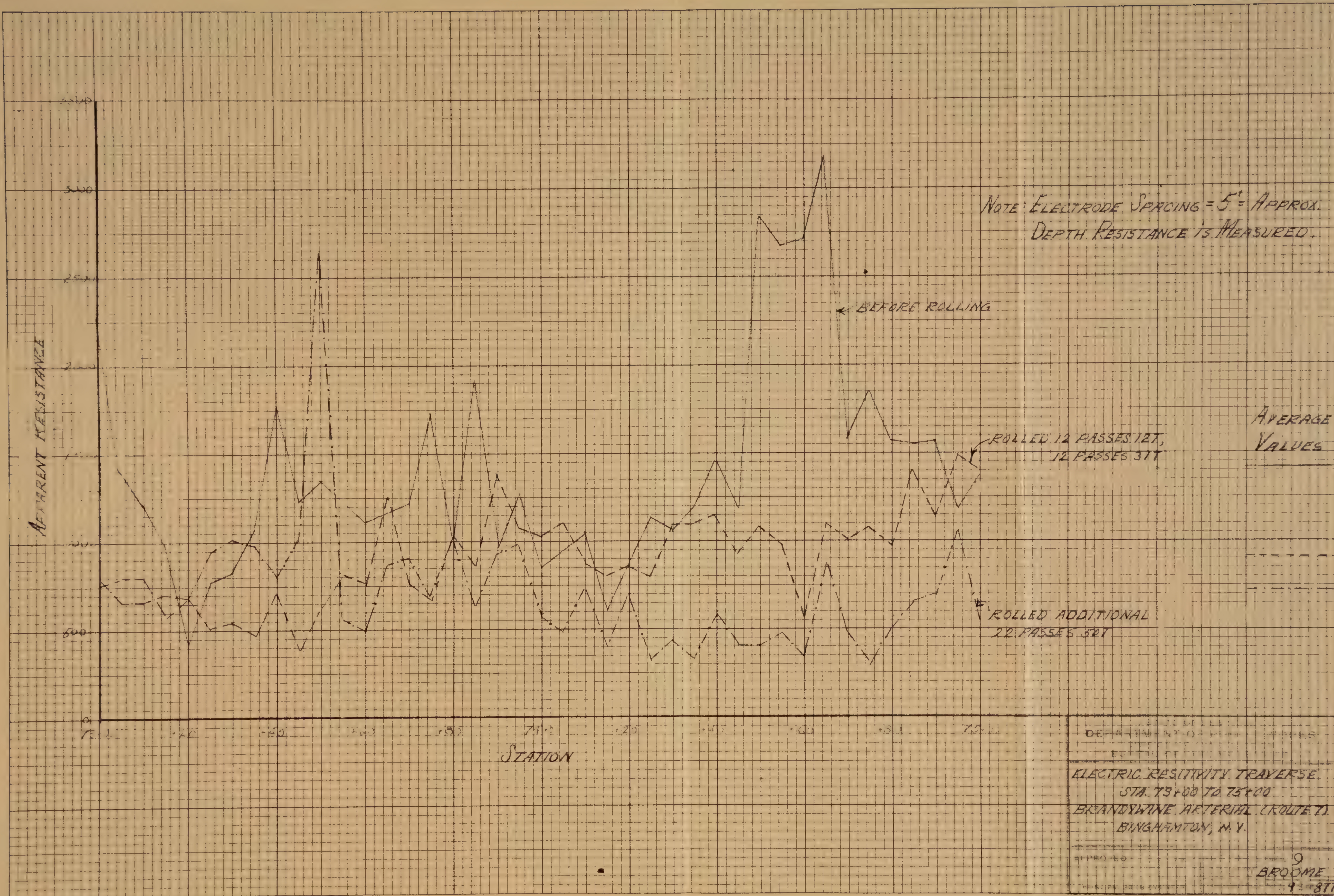
9
BROOME
9-4-877


NOTE: ELECTRODE SPACING = 15' = APPROX. DEPTH RESTIVITY IS MEASURED
AVERAGE VALUES
APPARENT RESISTIVITY
3000
2500
2000
1500
1000
500
BEFORE ROLLING
ROLLED 12 PASSES 12 TON
12 PASSES 31 TON
38½ PASSES 50 TON
63+00
+20
+40
+60
+80
+40
+60
+80
65+00
STATION
ELECTRIC RESISTIVITY TRAVERSE
STA. 63+00 TO 65+00
BRANDYWINE ARTERIAL (ROUTE 7)
BINGHAMTON, N.Y.
9
BROOME
9-4-877



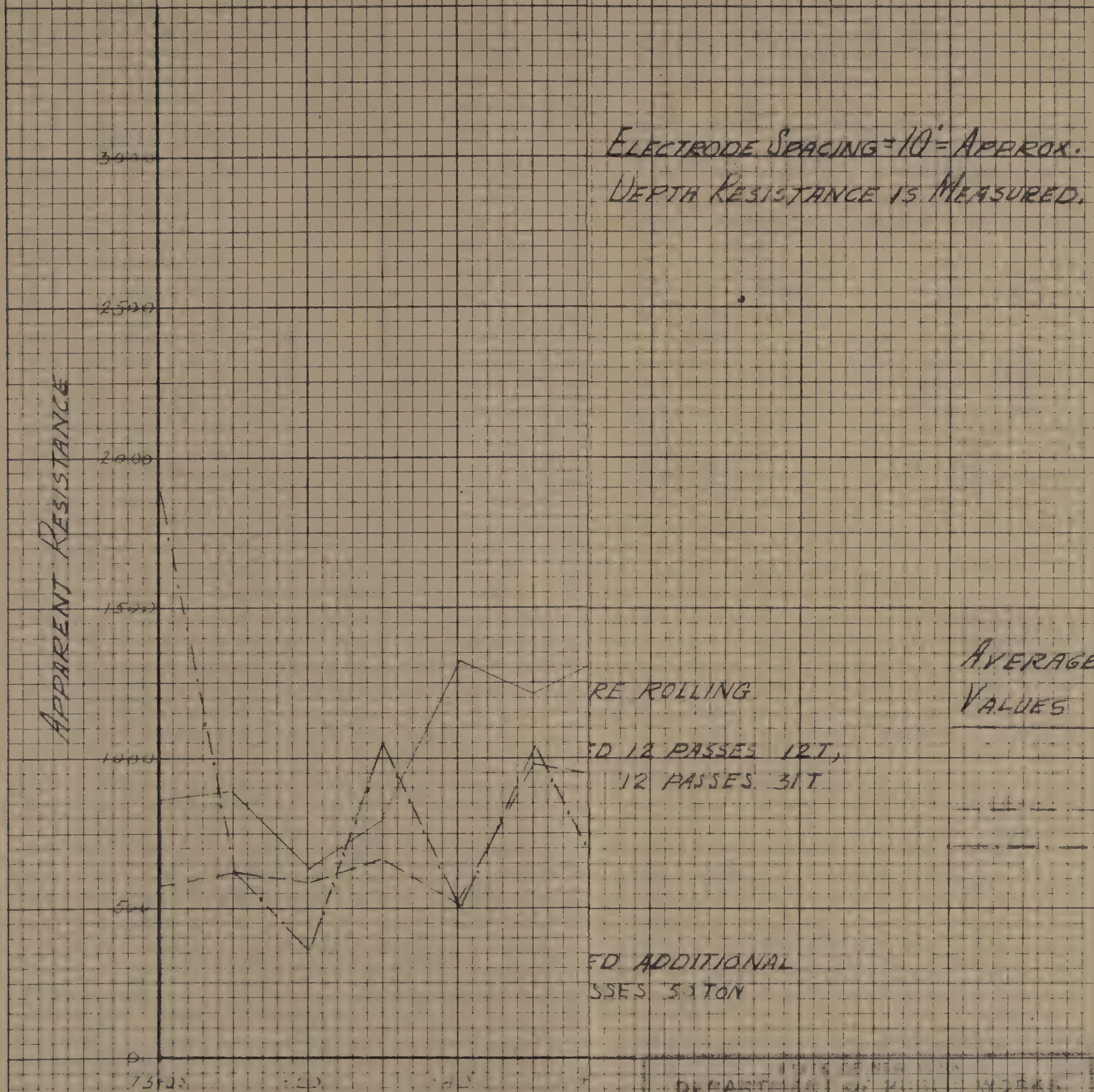
ELECTRODE SPACING = 5' ± APPROX.
DEPTH RESISTANCE IS MEASURED.
APPARENT RESISTANCE
3000
600
0
AVERAGE
VALUES
LED 12 PASSES 12T,
12 PASSES 31T
LED ADDITIONAL
PASSES 50T
ELECTRIC RESITIVITY TRAVERSE
STA. 73+00 TO 75+00
BRANDYWINE ARTERIAL (ROUTE 7)
BINGHAMTON, N.Y.
9
BROOME
9-877

M-C-15



NOTE: ELECTRODE SPACING = 5' ± APPROX.
DEPTH RESISTANCE IS MEASURED.
BEFORE ROLLING
ROLLED 12 PASSES 12T,
12 PASSES 37T
ROLLED ADDITIONAL
22 PASSES 50T
AVERAGE
VALUES
APPARENT RESISTANCE
600
0
STATION
ELECTRIC RESITIVITY TRAVERSE
STA. 73+00 TO 75+00
BRANDYWINE ARTERIAL (ROUTE 7)
BINGHAMTON, N.Y.
9
BROOME
9-877

FIG. C-16



ELECTRIC RESITIVITY TRAVERSE
STA. 73+00 TO 75+00
BRANDYWINE ARTERIAL (ROUTE 7)
BINGHAMTON, N.Y.

COUNTY BROOME

FIG. C-16

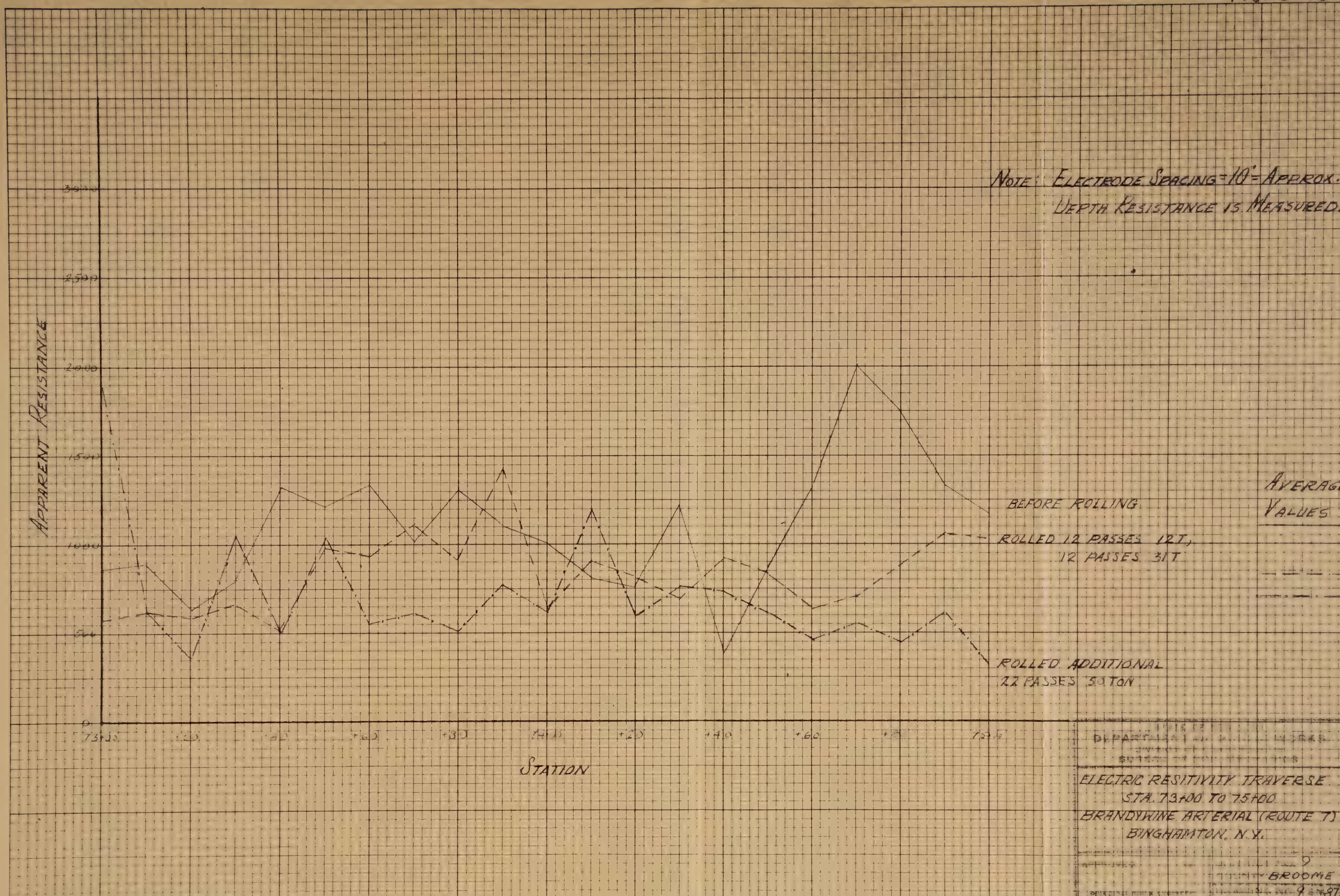

NOTE: ELECTRODE SPACING = 10' = APPROX.
DEPTH RESISTANCE IS MEASURED.
APPARENT RESISTANCE
3000
2500
2000
1500
1000
500
0
73+00
+20
+40
+60
+80
74+00
+20
+40
+60
+80
75+00
STATION
BEFORE ROLLING
ROLLED 12 PASSES 12T,
12 PASSES 31T
ROLLED ADDITIONAL
22 PASSES 50 TON
AVERAGE VALUES
ELECTRIC RESITIVITY TRAVERSE
STA. 73+00 TO 75+00
BRANDYWINE ARTERIAL (ROUTE 7)
BINGHAMTON, N.Y.
BROOME

FIG. [illegible]-17

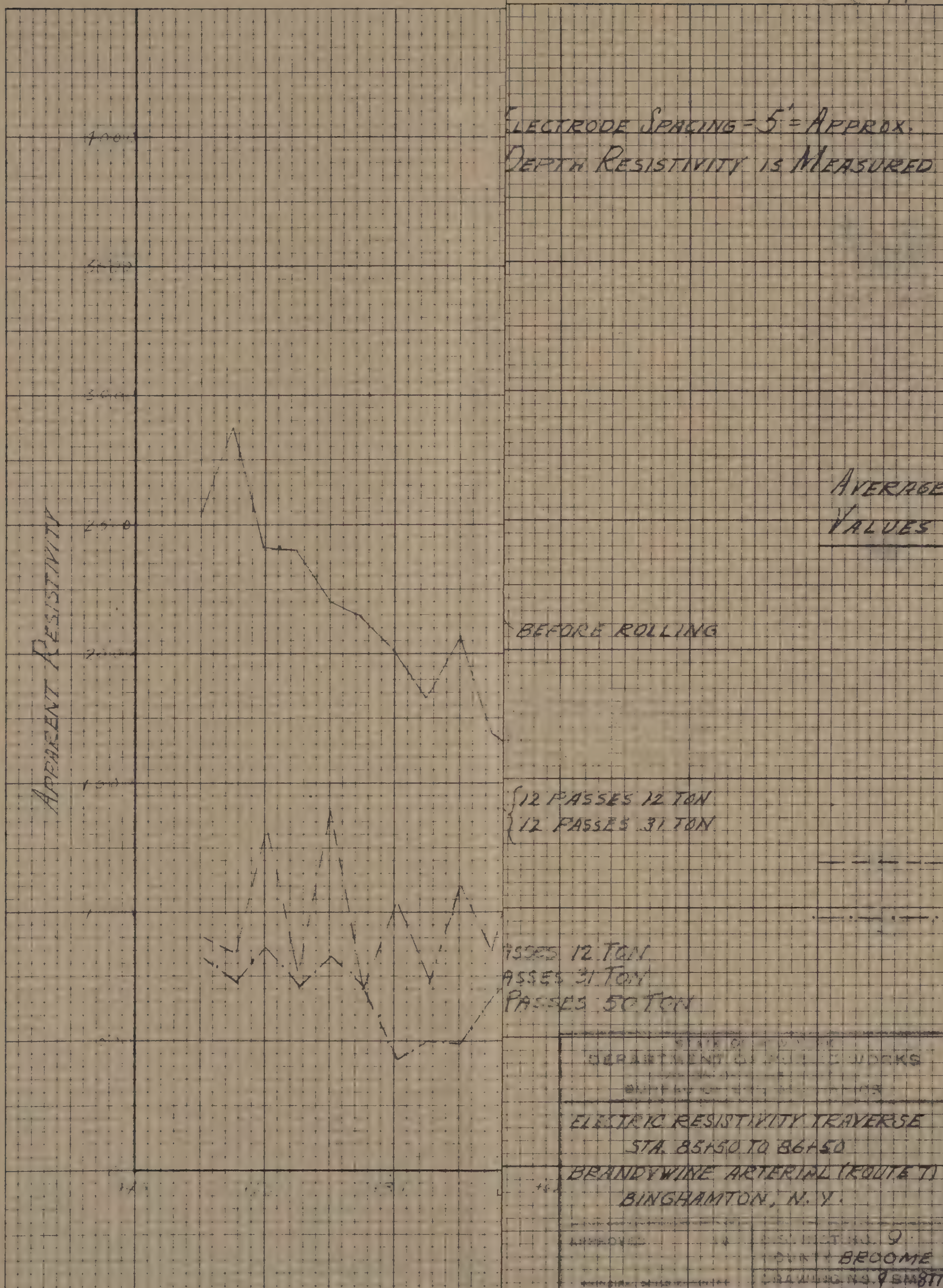
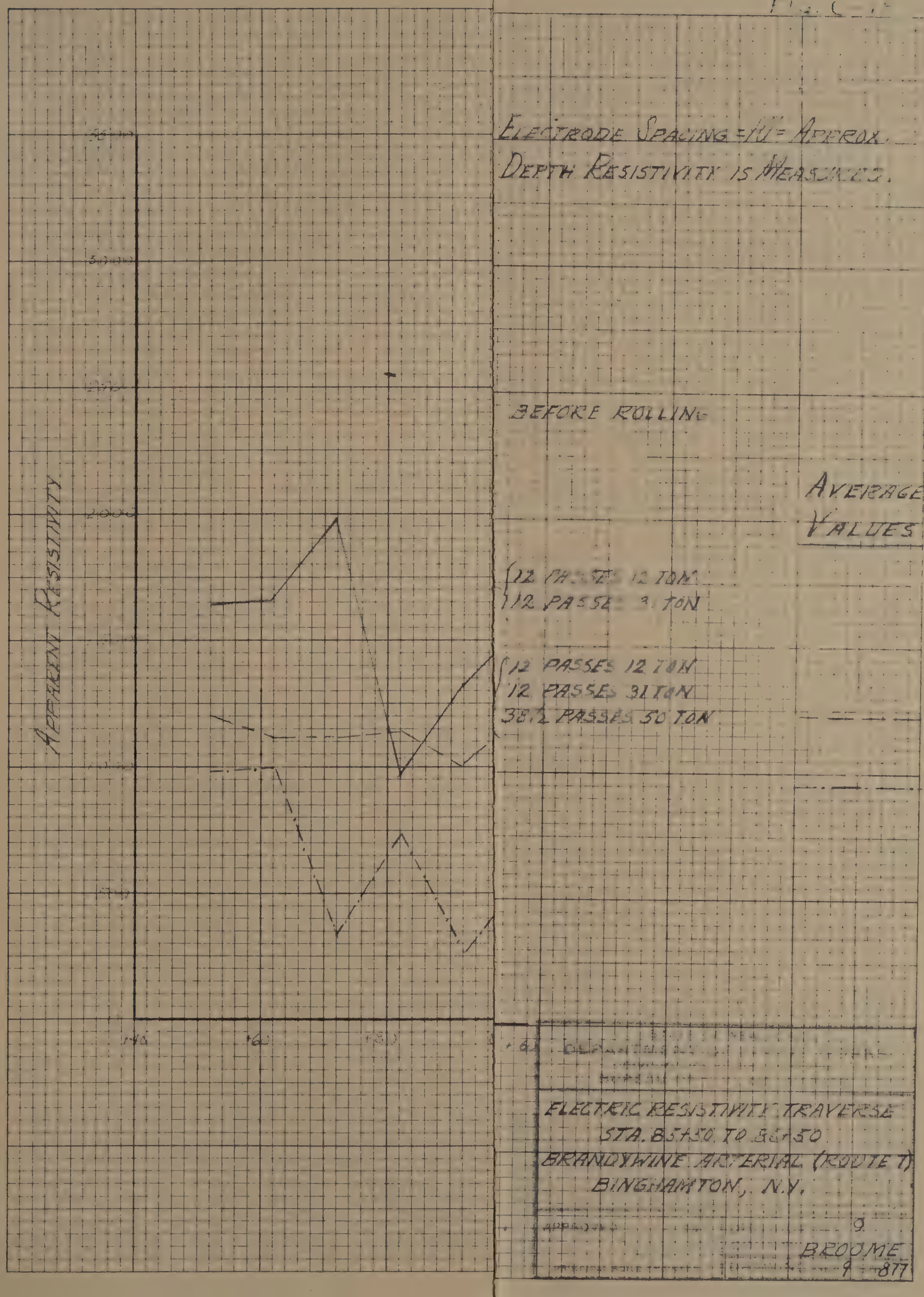

ELECTRODE SPACING = 5' = APPROX.
DEPTH RESISTIVITY IS MEASURED
AVERAGE
VALUES
APPARENT RESISTIVITY
BEFORE ROLLING
12 PASSES 12 TON
12 PASSES 31 TON
ELECTRIC RESISTIVITY TRAVERSE
STA. 85+50 TO 86+50
BRANDYWINE ARTERIAL (ROUTE 7)
BINGHAMTON, N.Y.
BROOME

FIG. C-17


NOTE: ELECTRODE SPACING = 5' = APPROX. DEPTH RESISTIVITY IS MEASURED.
APPARENT RESISTIVITY
STATION
BEFORE ROLLING
12 PASSES 12 TON
12 PASSES 31 TON
12 PASSES 12 TON
12 PASSES 31 TON
38 1/2 PASSES 50 TON
AVERAGE VALUES
DEPARTMENT OF PUBLIC WORKS
ELECTRIC RESISTIVITY TRAVERSE
STA. 85+50 TO 86+50
BRANDYWINE ARTERIAL (ROUTE 7)
BINGHAMTON, N.Y.
BROOME
9 SM877


ELECTRODE SPACING
APPARENT RESISTIVITY
BEFORE ROLLING
AVERAGE VALUES
12 PASSES 12 TON
12 PASSES 31 TON
38.2 PASSES 30 TON
ELECTRIC RESISTIVITY TRAVERSE
STA. 85+50 TO 88+50
BRANDYWINE ARTERIAL (ROUTE 7)
BINGHAMTON, N.Y.
9
BROOME
9-877

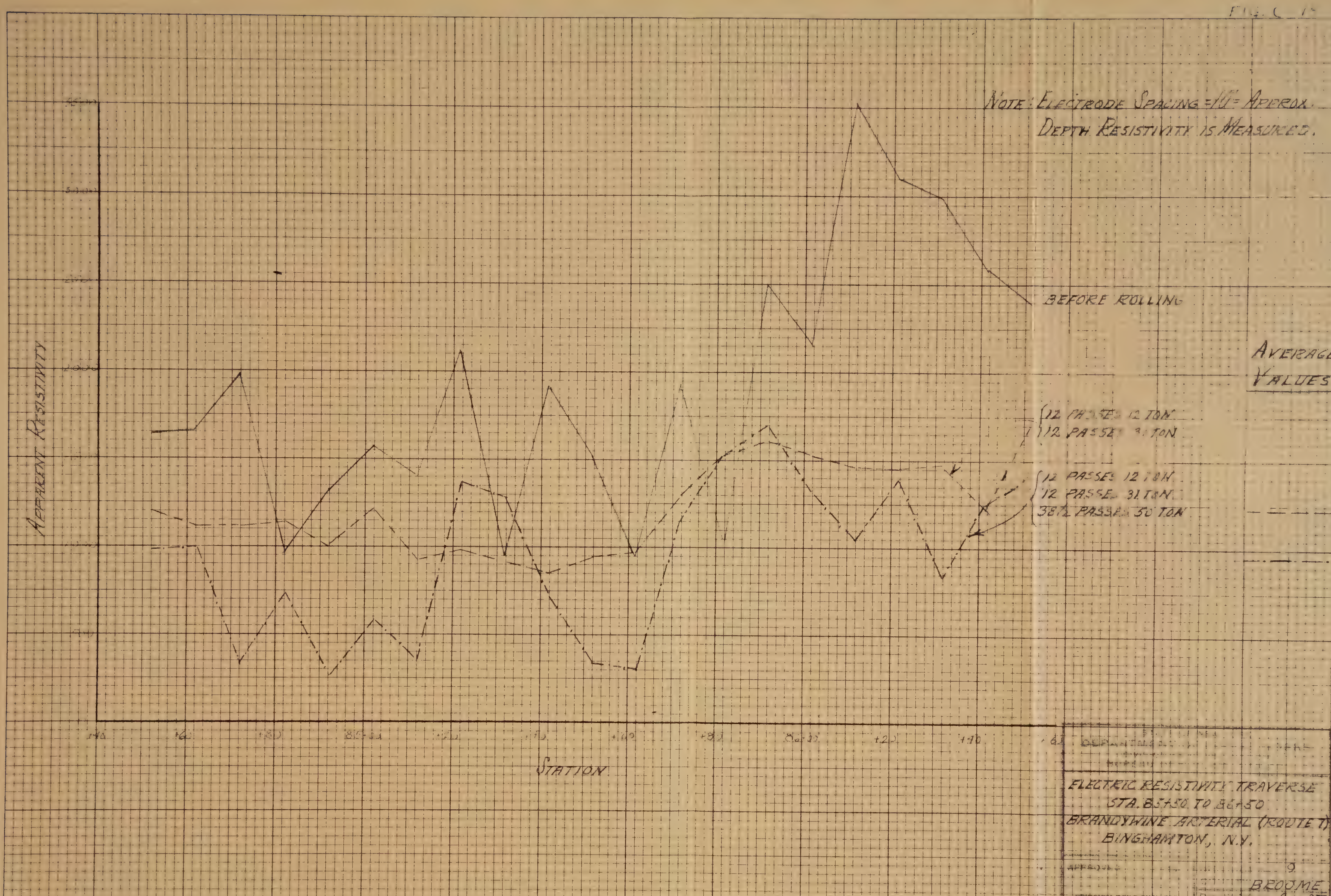
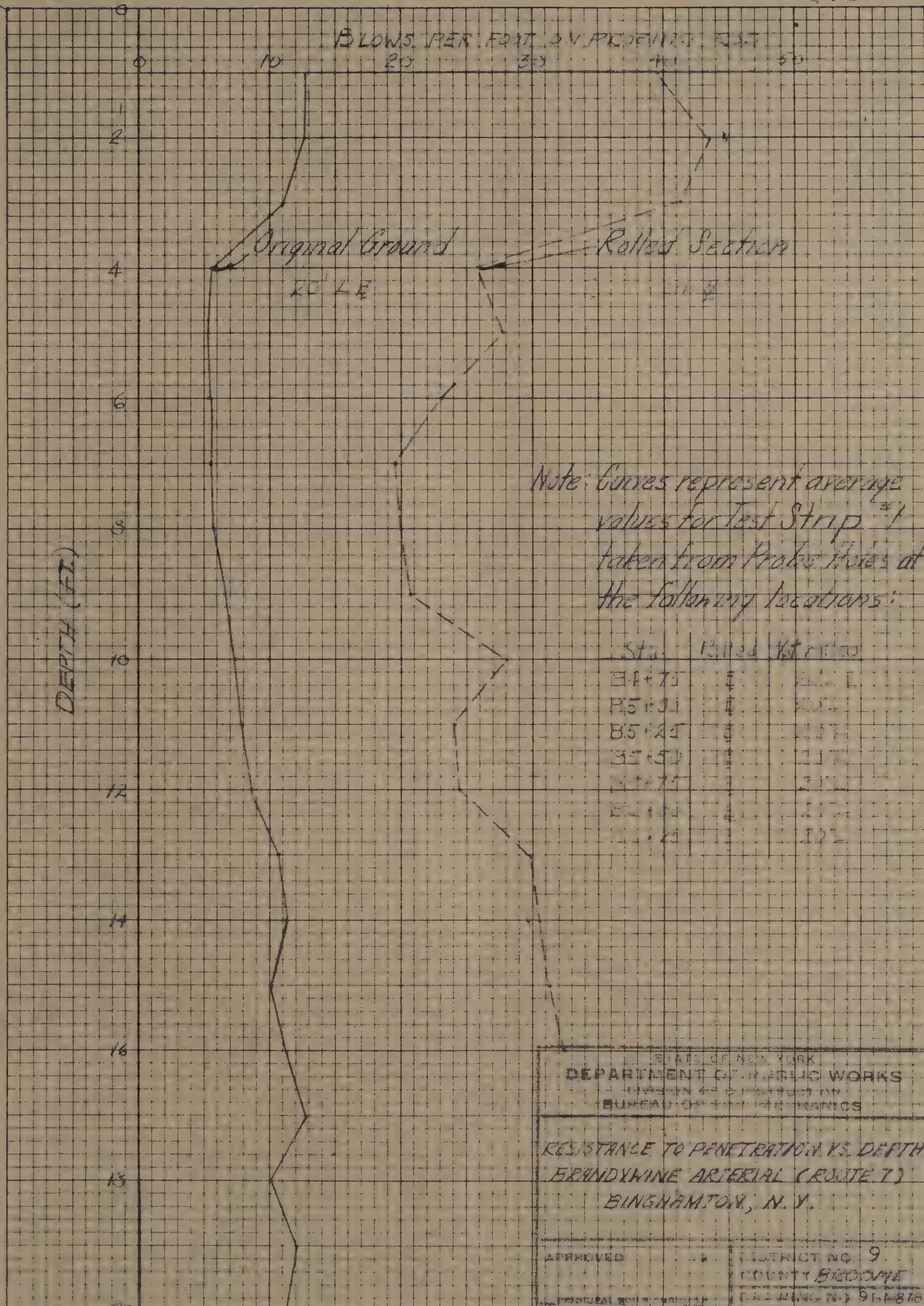


FIG. C-1
NOTE: ELECTRODE SPACING = 10' APPROX.
DEPTH RESISTIVITY IS MEASURED.
BEFORE ROLLING
AVERAGE VALUES
12 PASSES 12 TON
12 PASSES 31 TON
12 PASSES 12 TON
12 PASSES 31 TON
38½ PASSES 50 TON
APPARENT RESISTIVITY
STATION
+40
+60
+80
+20
+40
+60
+80
+20
+40
ELECTRIC RESISTIVITY TRAVERSE
STA. 85+50 TO 86+50
BRANDYWINE ARTERIAL (ROUTE 7)
BINGHAMTON, N.Y.
9
BROOME
877

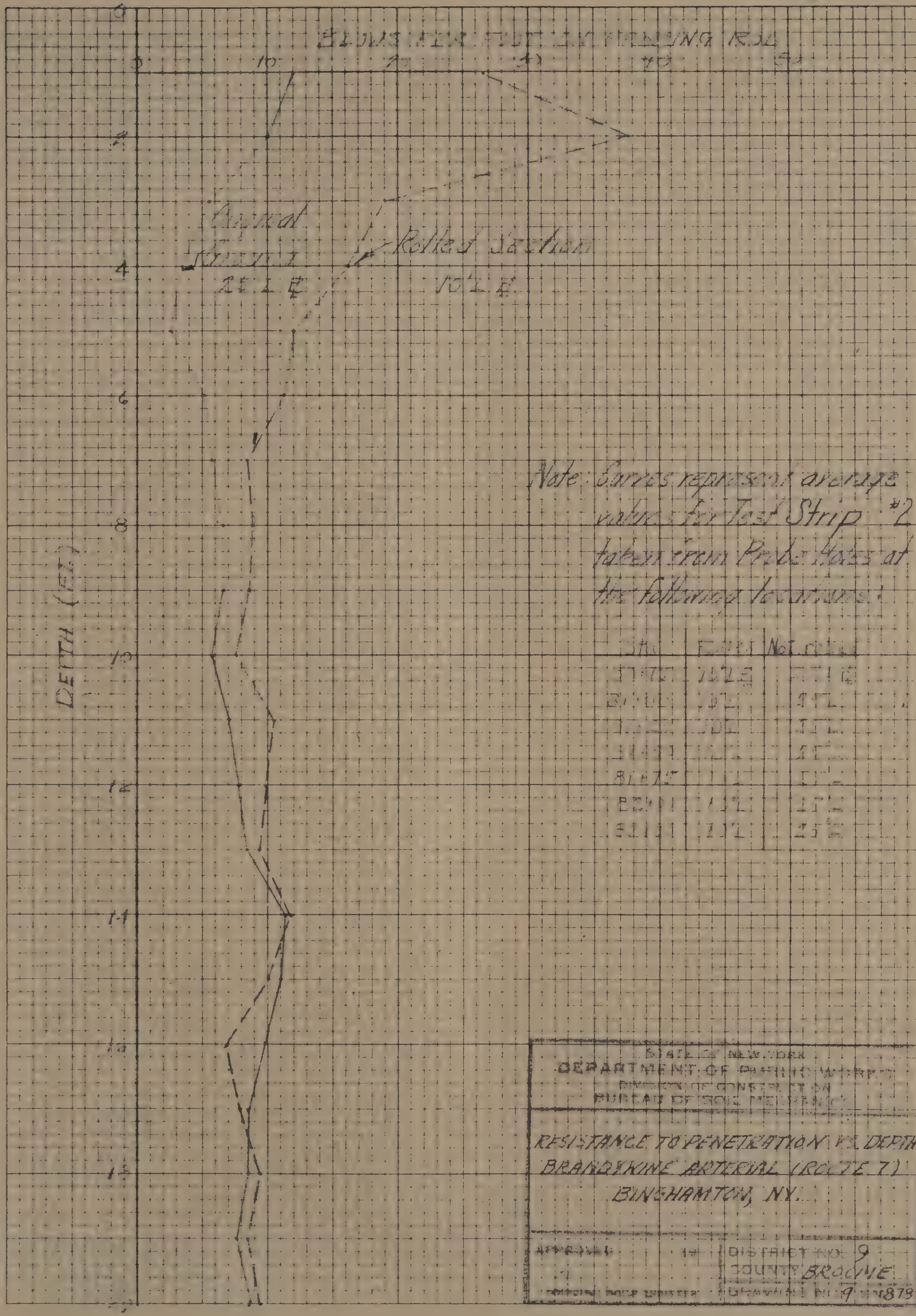
APPENDIX D

FIG. D-1



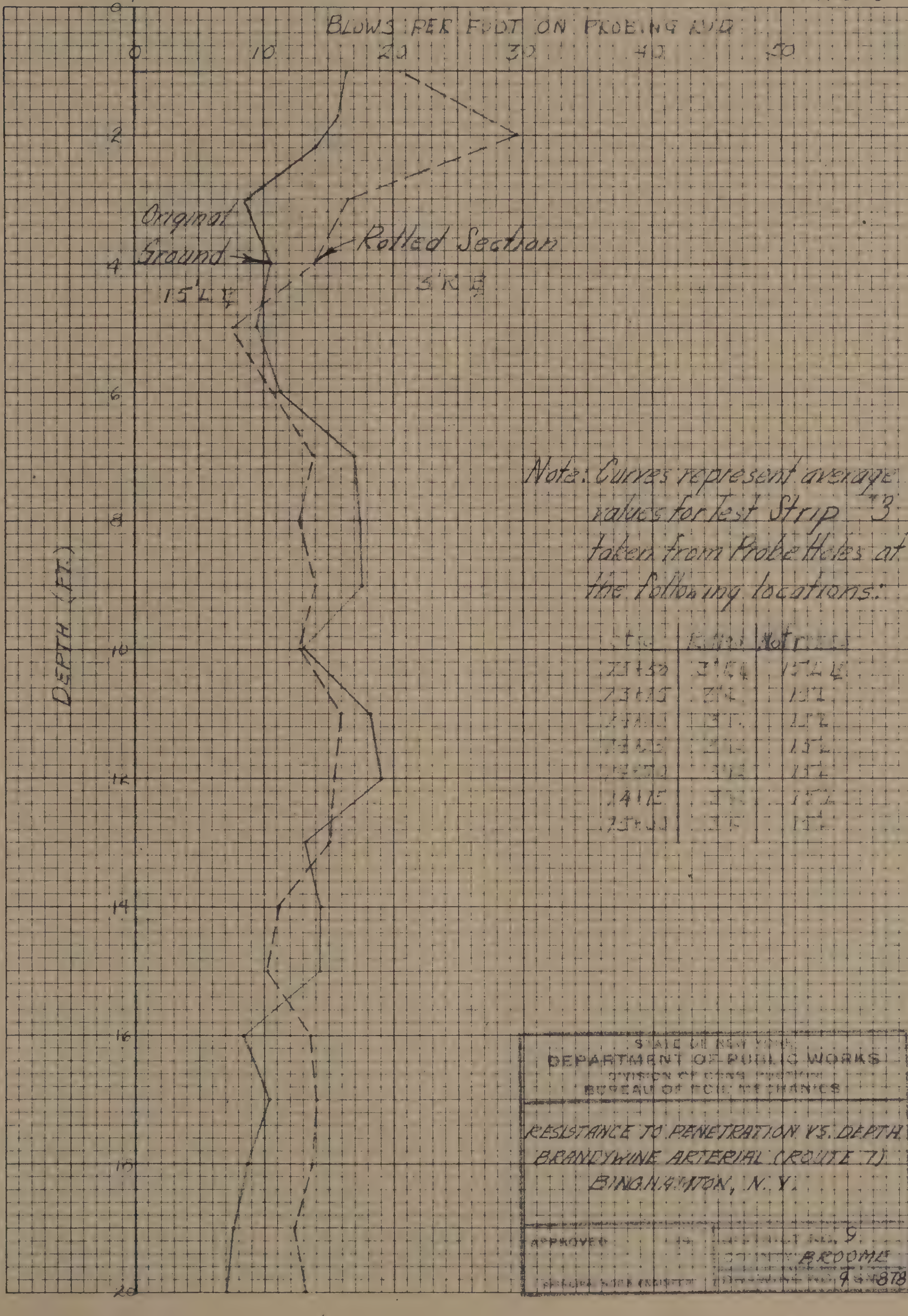
BLOWS PER FOOT
0
10
20
30
40
50
DEPTH (FT.)
2
4
6
8
10
12
14
16
18
20
Original Ground
Rolled Section
Note: Curves represent average values for Test Strip #1 taken from Probe Holes at the following locations:
Sta.
84+75
85+25
STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
BUREAU OF SOIL MECHANICS
RESISTANCE TO PENETRATION VS. DEPTH
BRANDYWINE ARTERIAL (ROUTE 7)
BINGHAMTON, N.Y.
APPROVED
DISTRICT NO. 9
COUNTY BROOME

FIG D-2



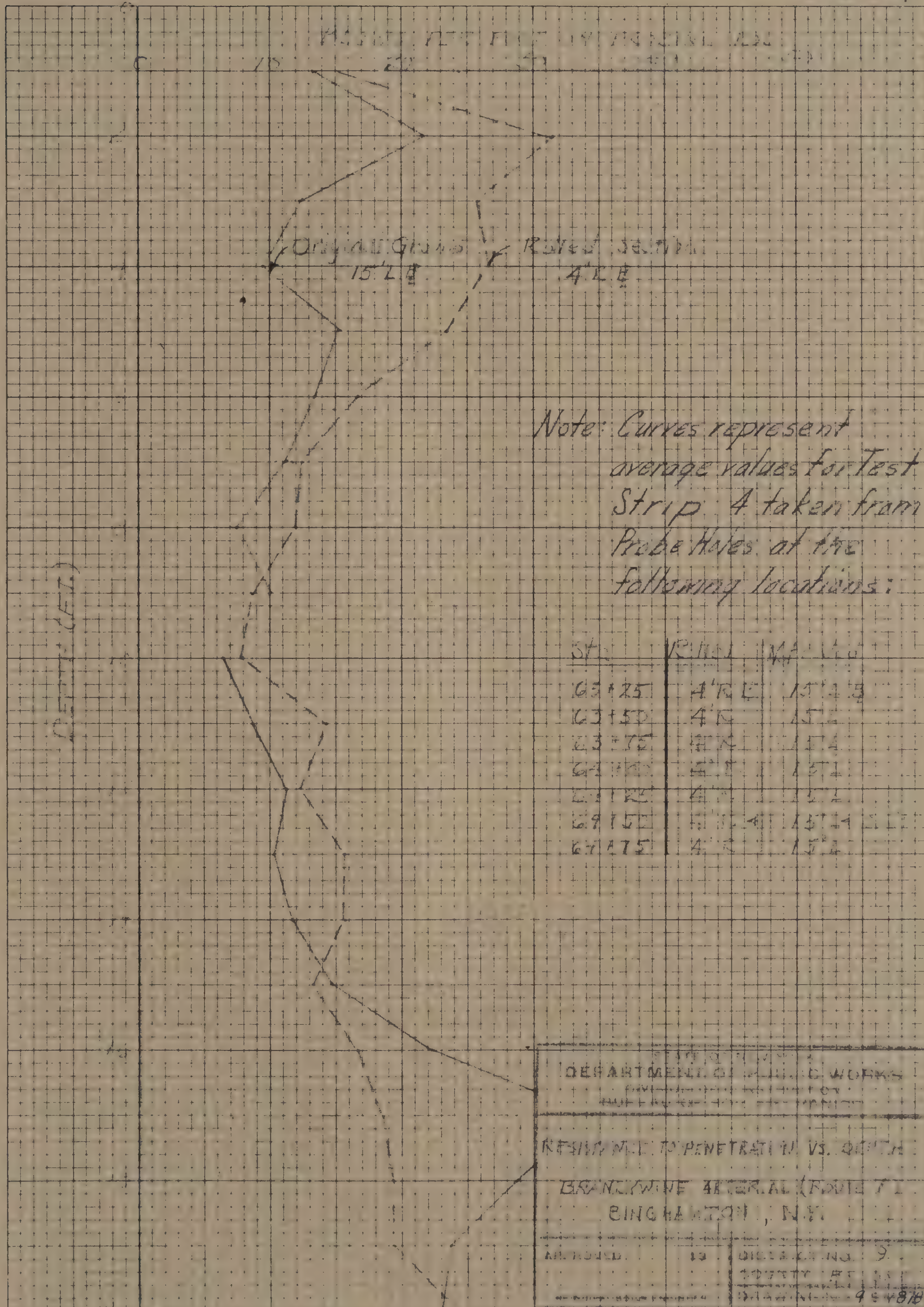
0
10
4
6
8
DEPTH
Rolled Section
Note: Curves represent average
values for Test Strip #2
taken from Probe Holes at
the following locations:
No. of
STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
RESISTANCE TO PENETRATION VS. DEPTH
BINGHAMTON, N.Y.
DISTRICT NO. 9
COUNTY BROOME

FIG. D-3



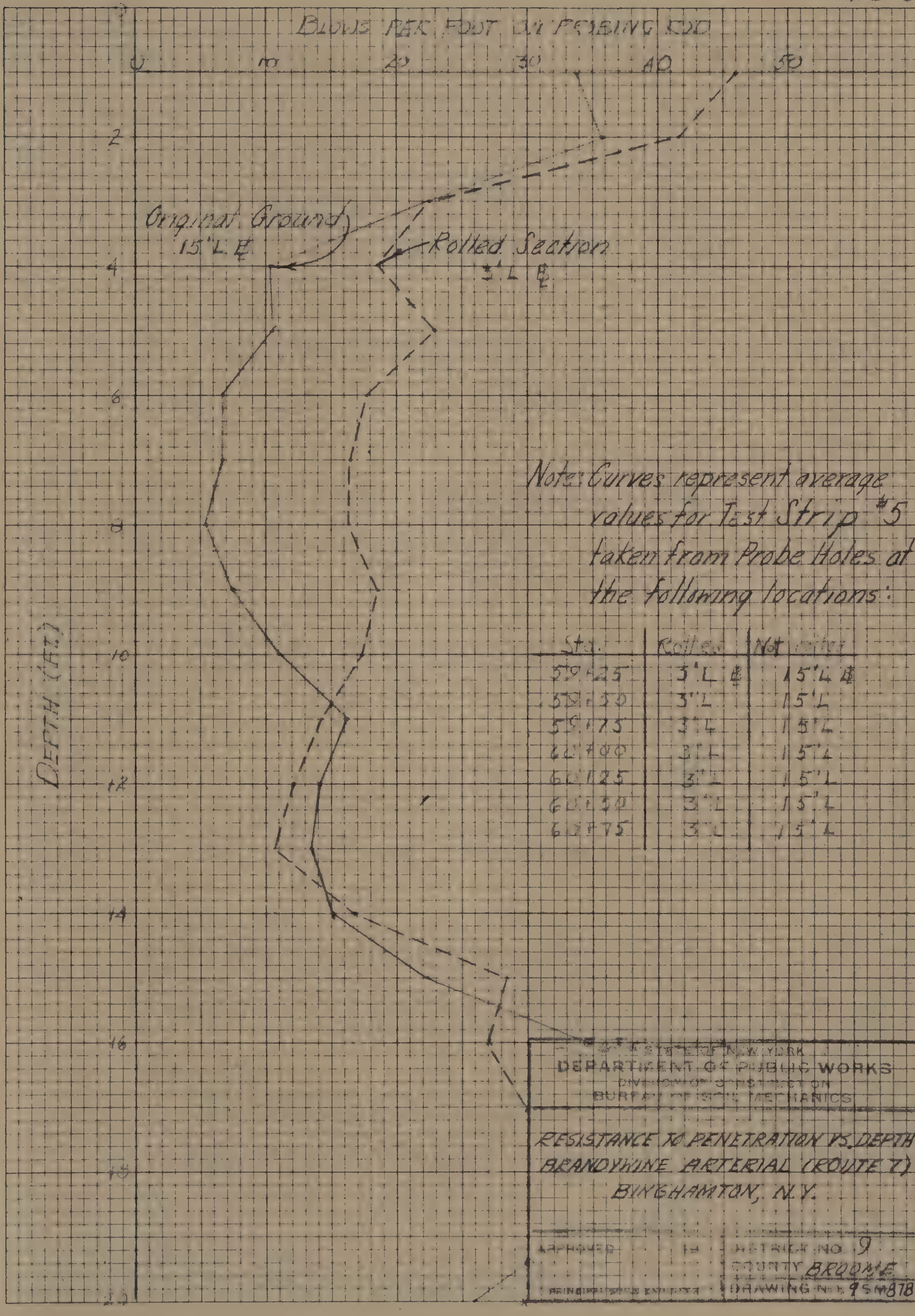
BLOWS PER FOOT ON PROBING ROD
0
10
20
30
40
50
DEPTH (FT.)
0
2
4
6
8
10
12
14
16
18
20
Original Ground
15 L E
Rolled Section
3 R E
Note: Curves represent average values for Test Strip #3 taken from Probe Holes at the following locations:
23+50
23+75
14+15
STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
BUREAU OF SOIL MECHANICS
RESISTANCE TO PENETRATION VS. DEPTH
BRANDYWINE ARTERIAL (ROUTE 7)
BINGHAMTON, N. Y.
APPROVED
9
BROOME
9-878

FIG. D-4



15' L.E
4' L.E
Note: Curves represent average values for Test Strip 4 taken from Probe Holes at the following locations:
St.
63+25
63+50
67+75
4' R.E
4' R
DEPARTMENT OF
WORKS
PENETRATION VS.
BINGHAMTON, N.Y.
9

FIG. D-5



Sta.	Rolled	Not rolled
59+25	3' L ℄	15' L ℄
59+50	3' L	15' L
59+75	3' L	15' L
60+00	3' L	15' L
60+25	3' L	15' L
60+50	3' L	15' L
60+75	3' L	15' L

STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
DIVISION OF CONSTRUCTION
BUREAU OF SOIL MECHANICS

RESISTANCE TO PENETRATION VS. DEPTH
BRANDYWINE ARTERIAL (ROUTE 7)
BINGHAMTON, N.Y.

APPROVED 19 DISTRICT NO. 9
COUNTY BROOME
PRINCIPAL SOILS ENGINEER DRAWING NO. 9SM878

Fig. D-6

TABULATED PENETRATION TEST DATA

TEST STRIP NO. 1
AT STATIONS SHOWN

Depth (ft.)	84+75 A	84+75 B	85+00 A	85+00 B	85+25 A	85+25 B	85+50 A	85+50 B	85+75 A	85+75 B	86+00 A	86+00 B	86+25 A	86+25 B
1	22	48	30	55	15	54	6	40	5	42	6	17	5	22
2	15	54	25	44	17	58	5	39	6	75	6	37	15	35
3	30	60	15	50	15	27	2	31	3	50	4	43	8	29
4	9	42	8	19	9	20	1	23	4	38	5	17	4	22
5	8	37	8	20	8	21	1	18	6	39	5	14	1	45
6	8	20	9	21	8	20	3	16	3	35	2	15	6	24
7	7	20	7	18	6	15	9	9	4	36	1	20	5	19
8	5	18	3	16	5	12	7	12	5	41	7	23	9	18
9	5	19	2	19	4	10	7	19	11	43	9	19	8	17
10	3	16	2	20	8	150	7	12	22	67	4	28	5	22
11	2	19	4	20	9	44	12	13	17	44	6	17	5	11
12	4	18	8	22	9	30	10	17	7	50	7	20	16	13
13	25	25	16	25	7	38	7	30	9	70	4	20	18	10
14	30	31	12	20	8	27	9	22	8	66	2	31	9	15
15	15	39	4	22	12	36	5	28	75	50	2	27	12	17
16	9	30	8	18	15	40	3	27	30	39	16	48	8	26
17	9	24	3	17	14	35	5	27	19	48	16	44	14	32
18	7	27	3	18	8	50	5	31	18	55	10	45	19	33
19	12	18	10	19	10	54	8	30	18	52	7	49	19	31
20	10	10	17	30	10	52	10	33	12	45	6	52	14	28

A = Blows per foot on probing rod, Station points 20 feet left of Base Line, area not rolled.
B = Blows per foot on probing rod, Station points on Base Line, are completely rolled.

Fig. D-7

TABULATED PENETRATION TEST DATA

TEST STRIP NO. 2

AT STATIONS SHOWN

Depth (ft.)	80+75 A	80+75 B	81+00 A	81+00 B	81+25 A	81+25 B	81+50 A	81+50 B	81+75 A	81+75 B	82+00 A	82+00 B	82+25 A	82+25 B	82+50 A	82+50 B
1	17	50	10	6	15	14	5	11	5	10	5	35	7	30	20	30
2	13	26	9	18	9	34	7	17	3	28	10	47	6	48	13	46
3	4	16	5	14	8	24	2	12	2	16	4	18	7	16	7	17
4	3	13	4	20	3	13	1	10	1	11	2	16	3	14	7	16
5	2	13	2	12	3	15	1	5	1	8	3	15	2	7	4	9
6	3	7	15	10	4	13	1	9	1	4	2	17	8	6	2	10
7	5	7	16	7	3	7	2	8	3	3	1	9	9	8	2	9
8	3	7	148	11	2	6	3	9	2	3	1	7	14	13	6	6
9	4	10	145	12	1	4	2	12	2	6	1	5	11	10	10	2
10	2	7	13	10	3	4	2	12	2	5	1	3	12	10	5	2
11	4	11	12	11	3	7	7	8	5	20	4	3	7	10	7	3
12	7	9	10	9	2	7	10	9	7	20	5	2	6	9	8	2
13	7	9	6	9	5	9	14	6	8	36	4	3	6	7	8	3
14	8	12	15	7	6	10	16	6	10	23	3	4	10	5	12	16
15	16	11	21	4	4	15	7	6	9	2	2	4	9	4	9	24
16	20	8	12	3	4	13	5	3	9	150	10	9	3	3	6	5
17	6	9	11	8	8	8	7	7	8	110	7	10	4	2	8	6
18	5	7	12	10	10	9	5	9	5	7	10	15	3	2	9	6
19	3	7	16	9	15	6	5	8	1	7	8	9	2	8	3	5
20	5	7	12	7	7	7	6	12	10	9	13	4	5	9	4	10

A = Blows per foot on probing rod, Station points 25 feet of Base line, area not rolled.

B = Blows per foot on probing rod, Station points 10 feet of Base Line, area completely rolled.

Fig. D-8

TABULATED PENETRATION TEST DATA
TEST STRIP NO. 3
AT STATIONS SHOWN

Depth (ft.)	73+50 A	73+50 B	73+75 A	73+75 B	74+00 A	74+00 B	74+25 A	74+25 B	74+50 A	74+50 B	74+75 A	74+75 B	75+00 A	75+00 B
1	18	12	25	20	23	18	10	23	8	33	13	20	18	29
2	10	35	33	9	20	27	14	27	33	37	13	35	4	37
3	8	16	14	8	10	15	5	17	6	20	12	19	5	21
4	12	18	7	8	13	17	16	23	6	11	13	10	5	11
5	11	15	7	7	11	9	8	8	9	6	12	4	10	5
6	8	14	11	6	15	8	7	11	8	8	17	19	12	10
7	7	21	18	14	18	11	14	16	21	12	15	35	24	9
8	9	15	10	17	21	6	30	12	10	10	34	14	7	15
9	10	17	8	9	9	7	12	15	13	17	20	27	10	6
10	15	20	7	6	9	10	15	10	19	12	20	11	6	21
11	19	24	17	5	14	10	29	25	80	9	59	16	9	14
12	20	10	24	8	11	10	16	60	27	11	20	15	14	9
13	8	6	11	11	13	10	16	24	19	11	16	34	9	9
14	5	9	8	13	29	9	10	8	21	8	69	18	7	11
15	5	9	8	15	7	9	13	13	26	10	33	12	9	3
16	8	18	10	10	6	10	9	11	6	13	7	26	13	7
17	8	16	14	8	8	13	11	9	8	20	10	27	13	5
18	9	16	14	13	7	12	8	9	5	16	7	24	12	6
19	6	15	12	9	10	13	5	10	5	14	5	19	10	6
20	7	12	13	8	4	14	5	12	6	9	6	17	8	9

A = Blows per foot on probing rod, Station points 15 feet left of Base line, area not rolled.
B = Blows per foot on probing rod, Station points 3 feet right of Base line, area completely rolled.

Fig. D-9

TABULATED PENETRATION TEST DATA

TEST STRIP NO. 4

AT STATIONS SHOWN

Depth (ft.)	63+25 A	63+25 B	63+50 A	63+50 B	63+75 A	63+75 B	64+00 A	64+00 B	64+25 A	64+25 B	64+75 A	64+75 B
1	10	27	11	19	19	7	13	5	16	11	10	22
2	14	36	30	50	16	24	15	15	16	19	40	45
3	1	13	15	30	10	17	20	19	16	29	11	47
4	1	18	10	15	12	15	12	24	10	31	12	13
5	1	19	13	12	31	25	18	40	15	24	14	21
6	3	8	20	7	7	29	12	21	7	20	31	19
7	2	6	5	11	11	15	6	9	9	21	34	13
8	3	5	5	7	13	12	5	12	9	23	10	12
9	3	5	4	9	16	8	4	10	15	10	18	10
10	3	7	3	6	9	7	4	8	7	9	12	10
11	6	11	7	13	13	14	11	16	12	15	10	16
12	8	11	8	11	14	9	13	14	11	15	13	14
13	7	12	6	11	11	15	10	21	17	22	11	14
14	6	8	6	9	10	12	18	27	19	25	12	12
15	15	10	4	10	20	10	20	17	18	20	12	13
16	25	10	15	15	22	19	27	20	20	17	24	19
17	54	16	45	10	48	25	32	19	22	20	27	22
18	49	14	13	7	41	28	28	19	11	24	30	26
19	31	16	19	9	15	29	12	20	29	25	37	19
20	16	22	12	19	13	27	16	31	28	25	54	22

A= Blows per foot on probing rod, Station points 15 feet left of Base Line, area not rolled.
B= Blows per foot on probing rod, Station points 4 feet right of Base line, area completely rolled.

TABULATED PENETRATION TEST DATA

TEST STRIP NO. 5

AT STATIONS SHOWN

Depth (ft.)	59+25 A	59+25 B	59+50 A	59+50 B	59+75 A	59+75 B	60+00 A	60+00 B	60+25 A	60+25 B	60+50 A	60+50 B	60+75 A	60+75 B
1	20	40	32	52	39	41	32	37	47	52	32	63	35	37
2	27	38	23	47	25	49	59	52	38	40	49	31	30	65
3	24	39	10	20	22	20	9	19	39	23	29	19	24	15
4	12	22	8	25	8	17	5	17	9	19	10	9	19	21
5	13	52	4	19	5	26	4	23	12	15	19	11	17	15
6	4	27	3	17	17	15	4	25	10	14	8	106	5	12
7	6	29	4	18	13	20	11	18	4	11	6	16	4	4
8	6	30	7	19	2	18	7	19	7	11	3	11	6	7
9	8	35	3	30	3	15	9	10	11	17	12	16	8	8
10	13	20	4	37	6	17	15	10	15	8	15	19	10	10
11	17	18	10	25	9	17	20	12	16	8	17	9	15	11
12	14	17	16	10	8	8	18	11	11	21	17	8	14	9
13	10	10	10	10	7	9	16	9	16	19	21	6	14	12
14	10	30	10	16	7	11	23	25	11	11	29	9	16	16
15	13	75	17	19	12	27	43	20	29	31	22	45	20	27
16	64	27	33	24	27	29	57	19	70	22	31	32	35	36
17	38	31	48	30	39	25	49	31	73	28	29	37	38	28
18	35	42	40	31	30	30	49	43	54	26	25	23	37	30
19	29	30	39	29	27	39	38	44	30	30	36	26	30	28
20	25	29	29	30	23	39	40	31	23	30	20	28	31	20

A = Blows per foot on probing rod, Station points 15 feet left of Base line, area not rolled.

B = Blows per foot on probing rod, Station points 3 feet right of Base line, area completely rolled.

Fig. D-10

N.Y.S. - D.P.W. - B of S.M.
AUTHOR
Foundation Rolling Rt. #7
TITLE
Brandywine Arterial Ext.

DATE LOANED	BORROWER'S NAME	DATE RETURNED
	Bingha	